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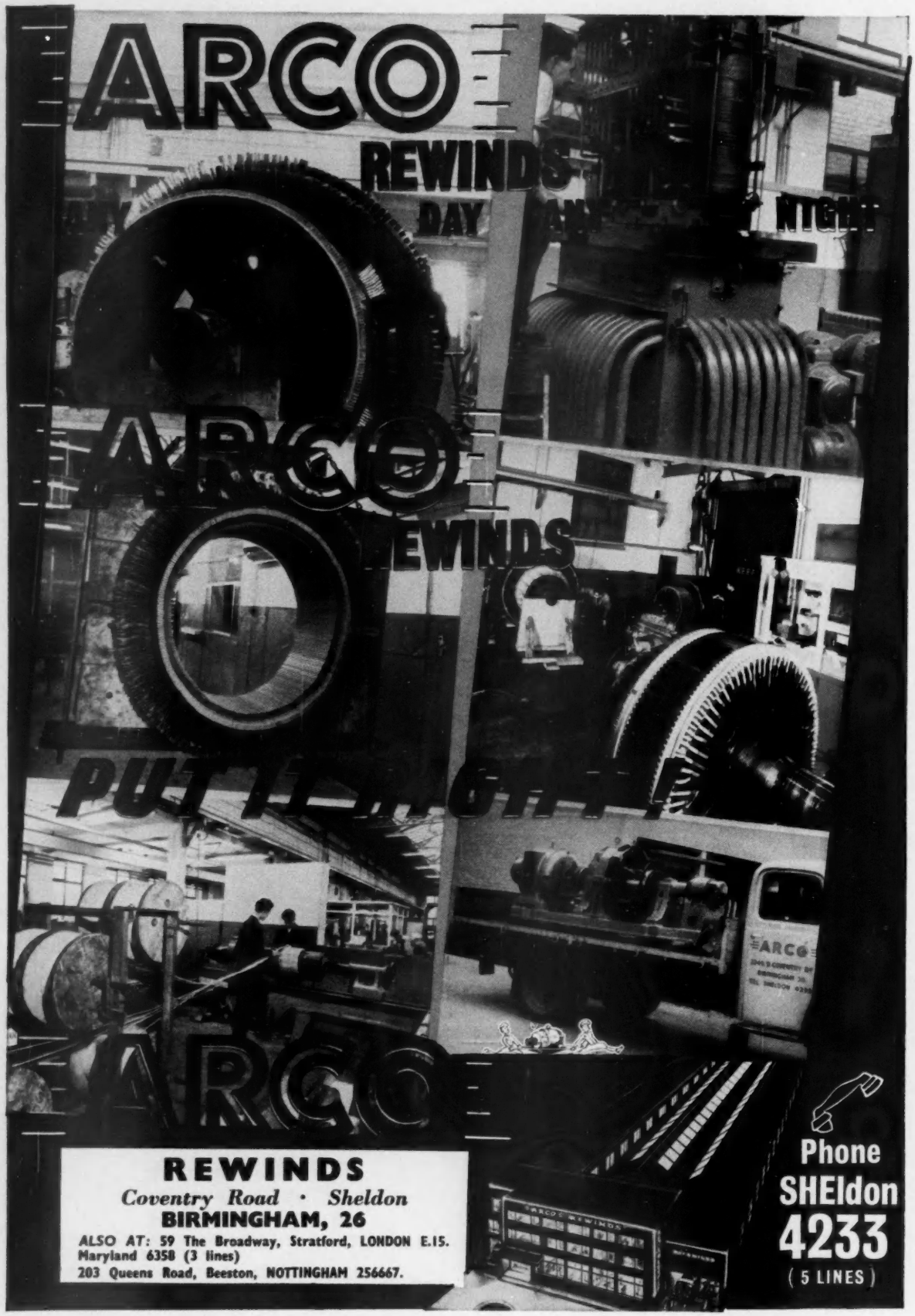
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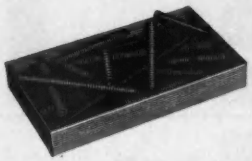
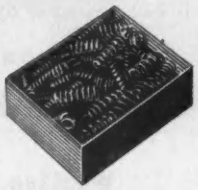
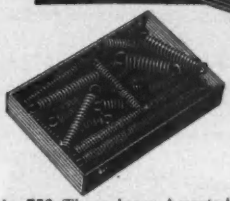


No. 1200. Three dozen Assorted Light Expansion Springs, suitable for carburettor control, etc. **15/-.**



No. 98A. Three dozen Assorted 1" to 4" long, ½" to ¼" diam., 19G to 15G. **6/6.**



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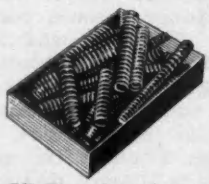
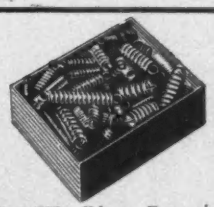


No. 760. Three dozen Assorted Light Compression Springs. 1" to 4" long, 22 to 18 S.W.G., ¼" to ½" diam. **7/6.**

No. 757. Extra Light Compression, 1 gross Assorted, ½" to ⅝" diam., ½" to 2½" long, 27 to 19 S.W.G. **18/-.**



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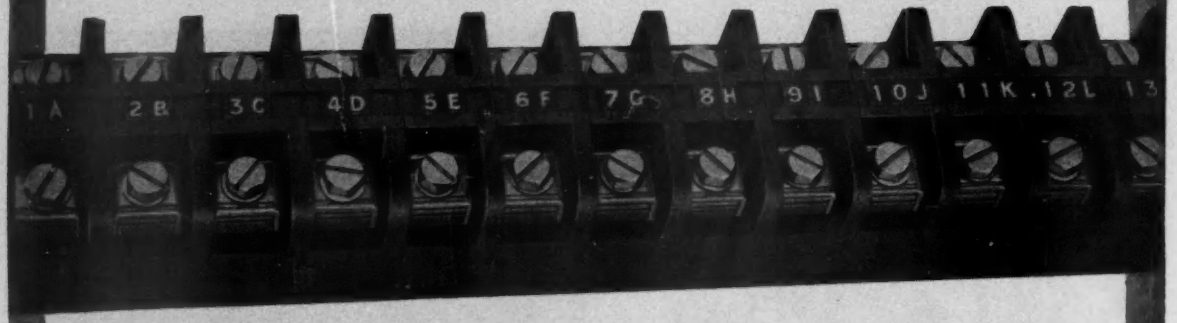
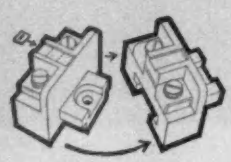


M·T·E MULTI-LOCK TERMINAL BLOCKS



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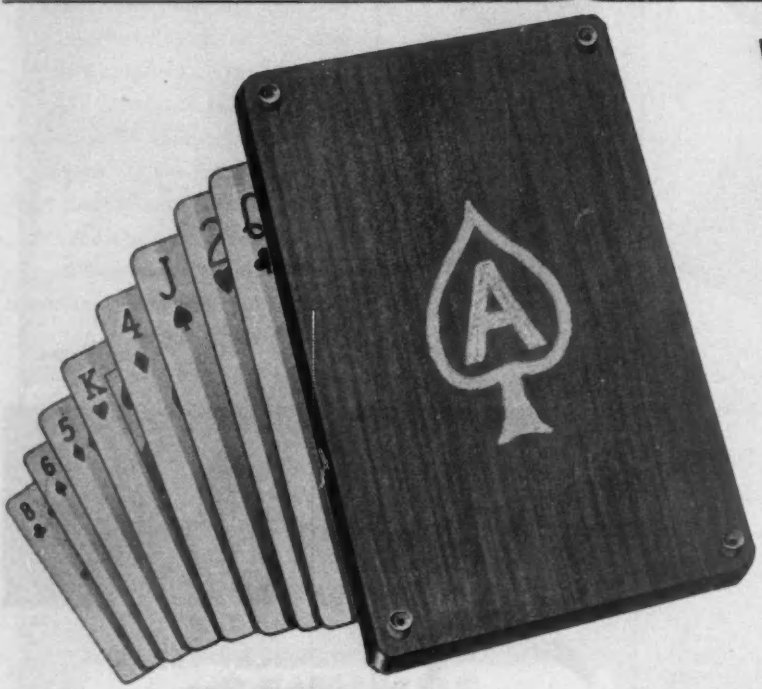

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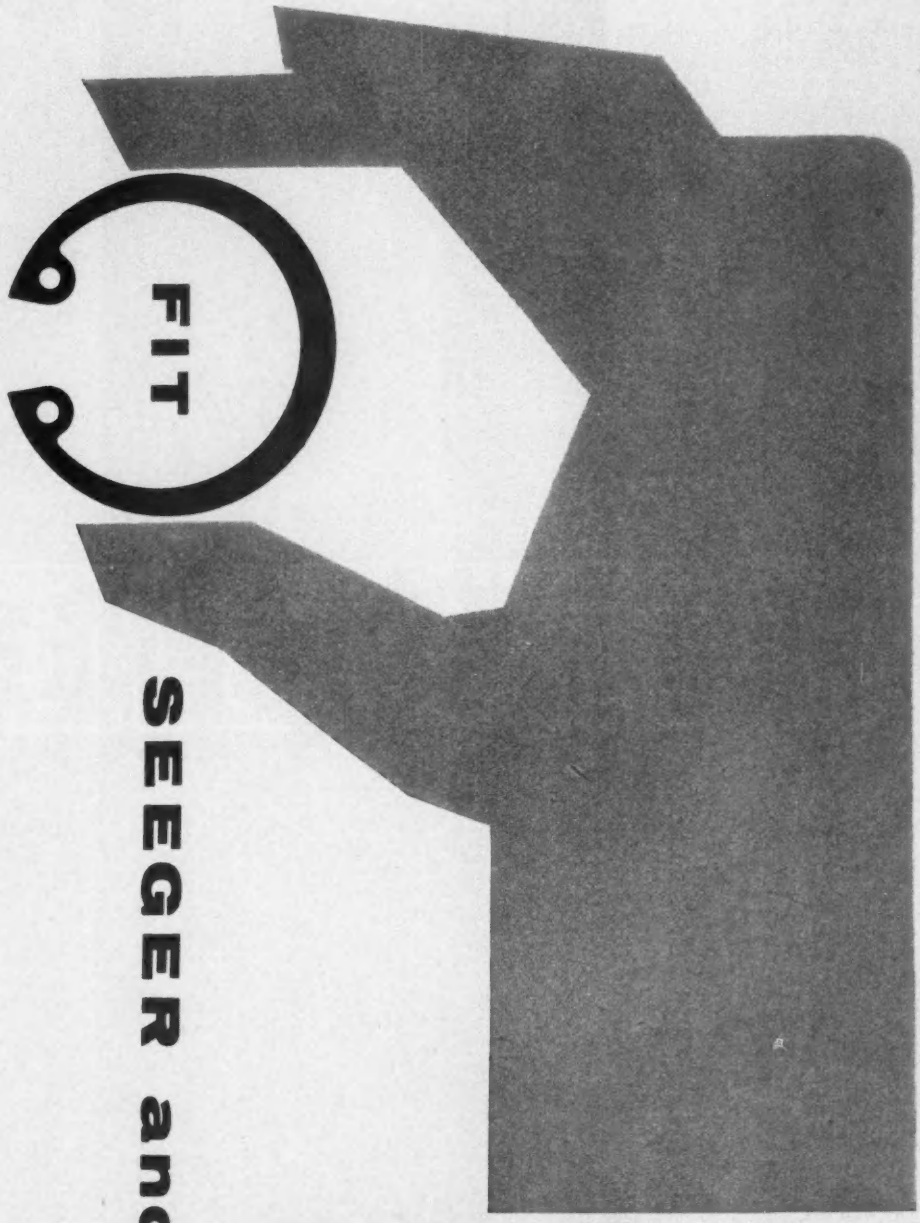

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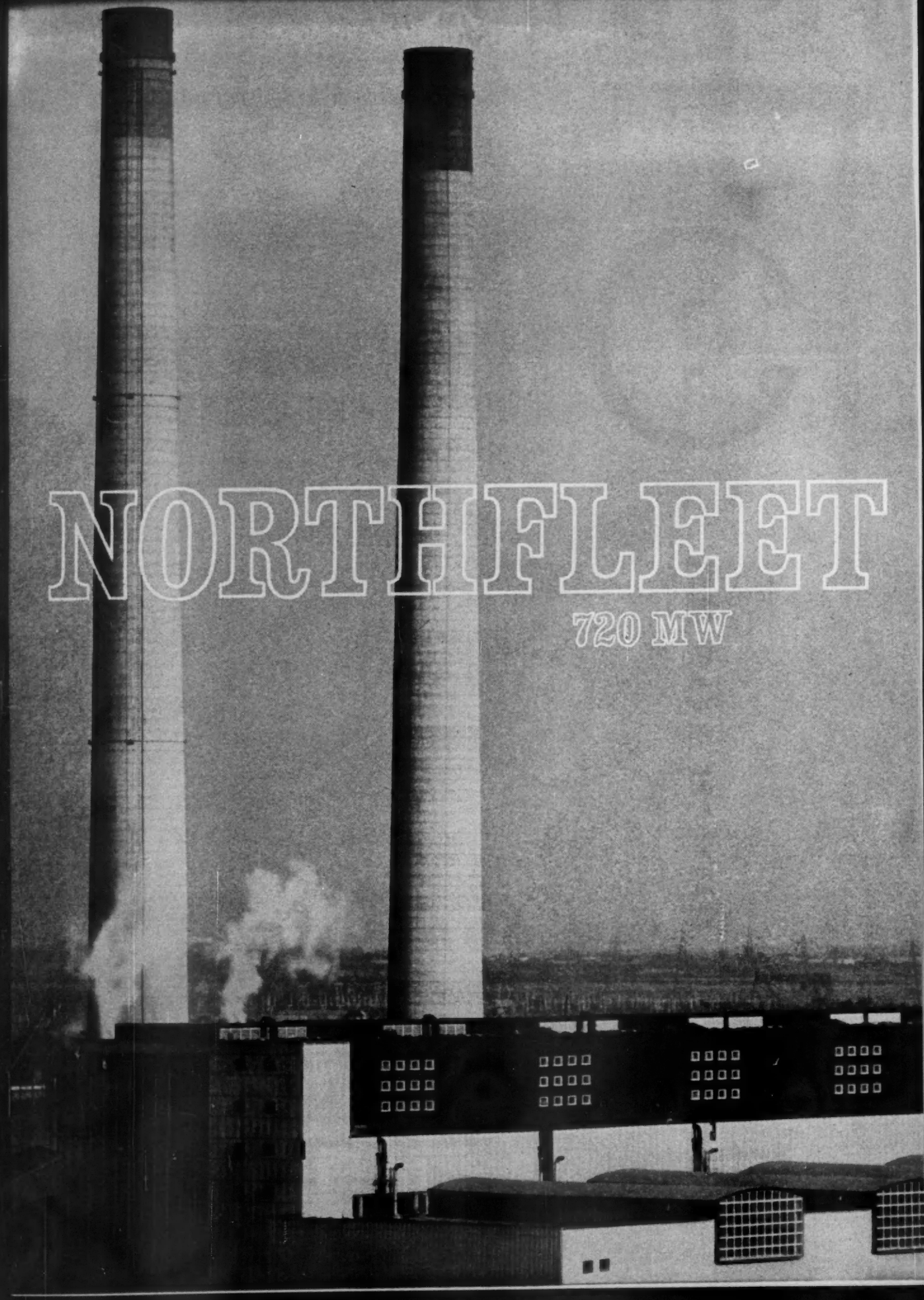
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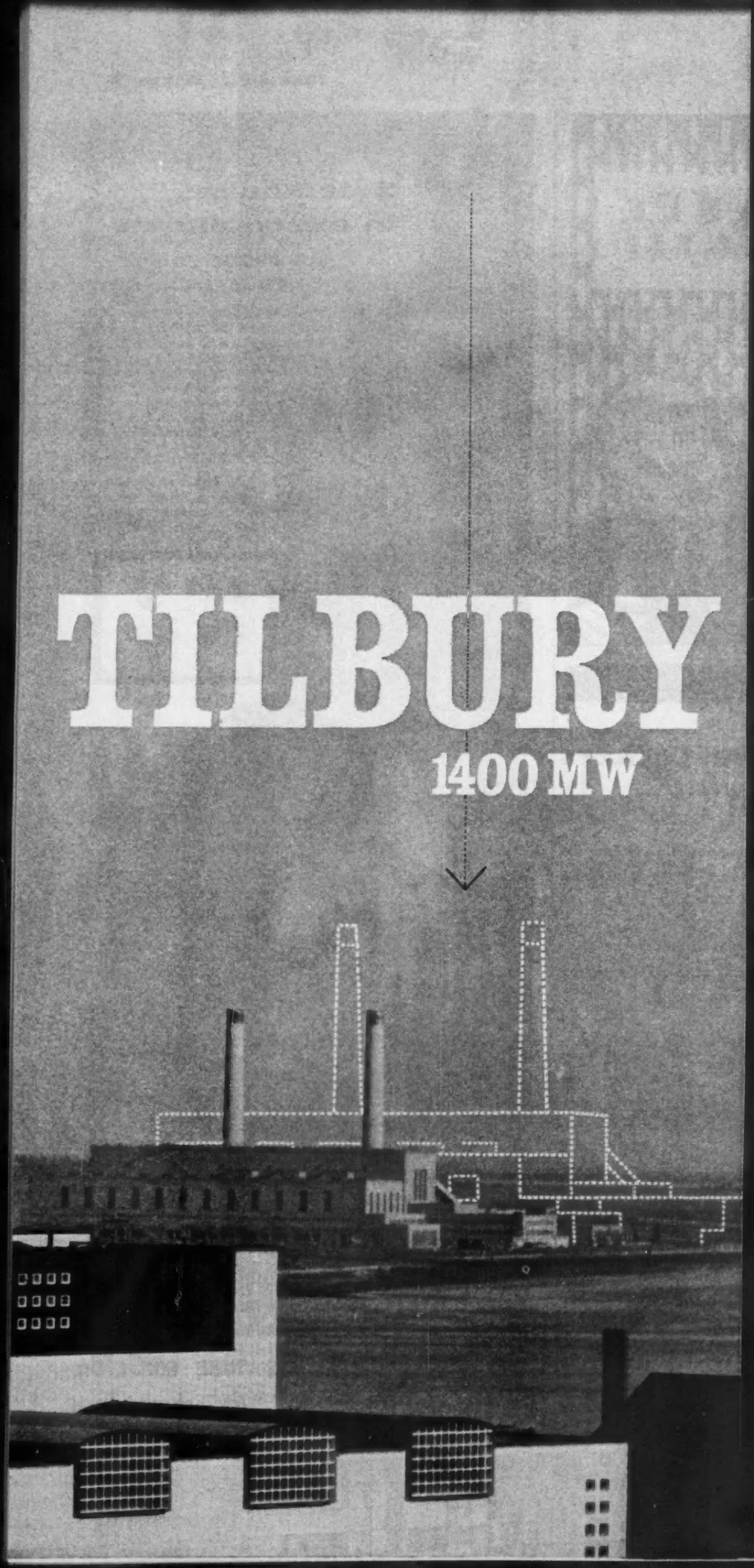
720 MW



G.E.C. to provide four

350 MW

reheat turbo-generators for new Thames-side station

The Central Electricity Generating Board's new Tilbury B power station is to be equipped with turbo-generators manufactured by The General Electric Company Limited of England.

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1400 MW

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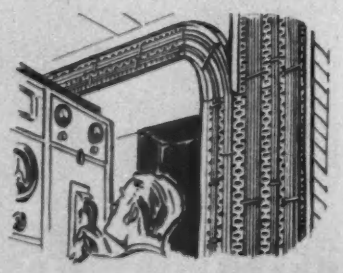

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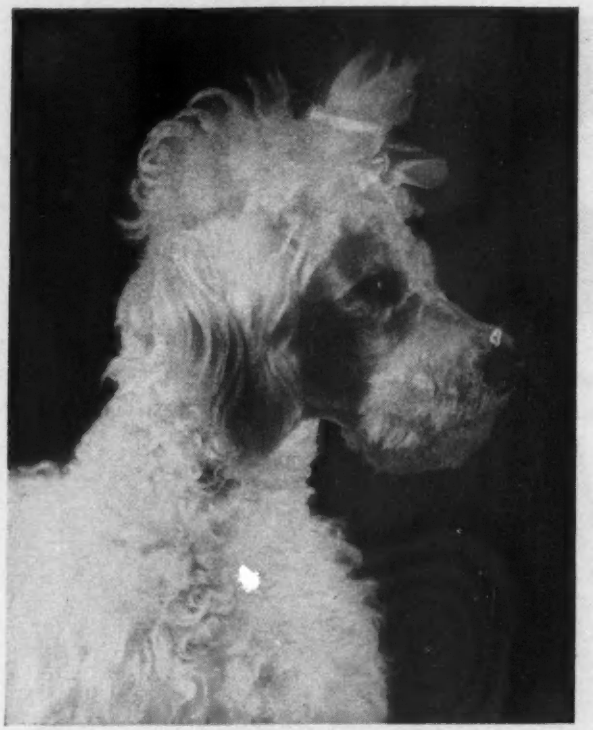

Quality at the Dog Show, Prize Poodle *(Photo Thomas Fall)*

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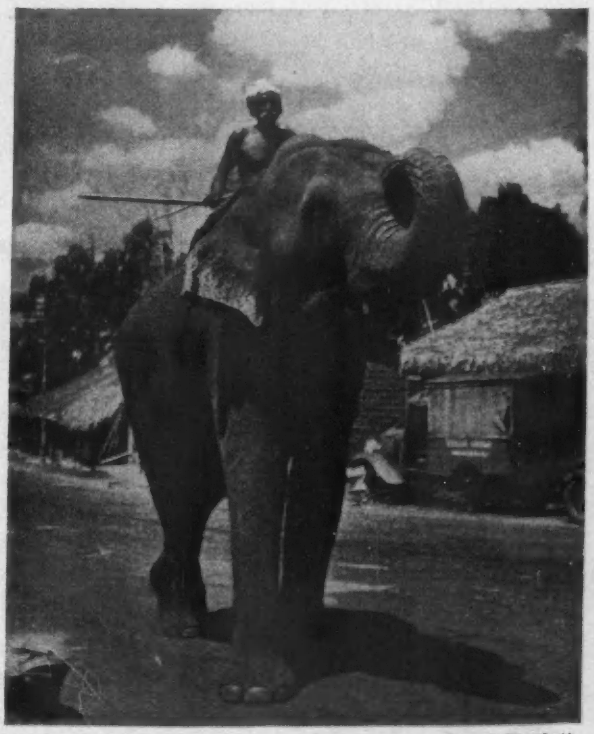

Service by Elephant, Ceylon *(Photo J. Allan Cash)*

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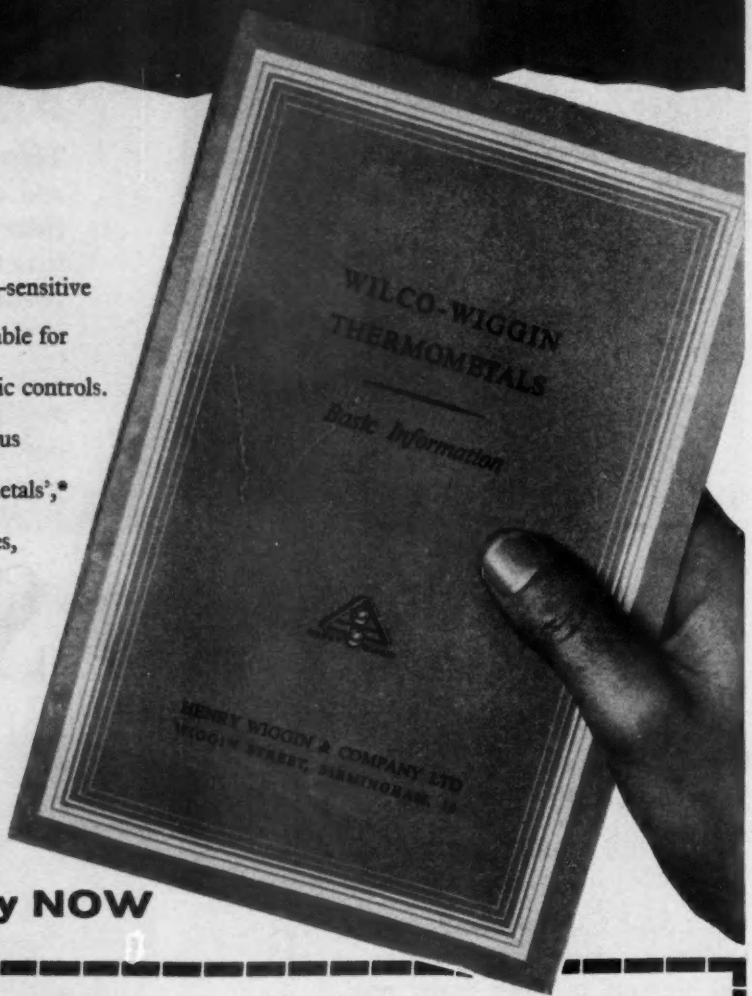

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NEWS SHEET

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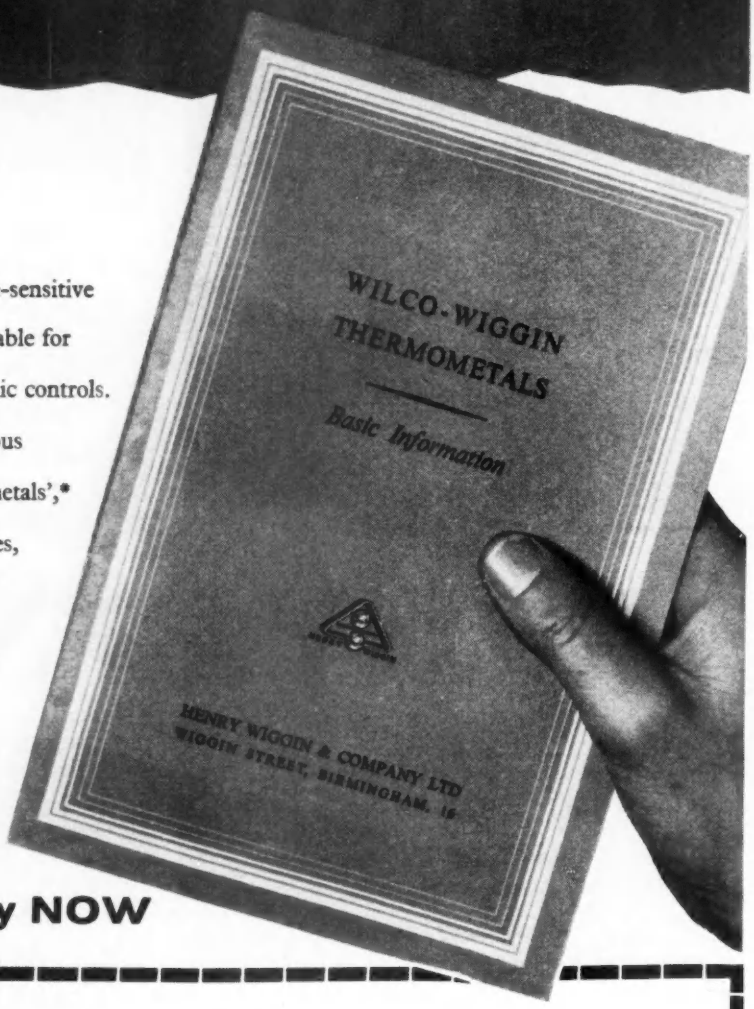

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The continual increase in the use of electric power consuming devices in all types of buildings calls for well designed distribution equipment of proved performance. 'ENGLISH ELECTRIC' meet these requirements with their 'Superform' Switchboards and 'Red Spot' Fuseboards.

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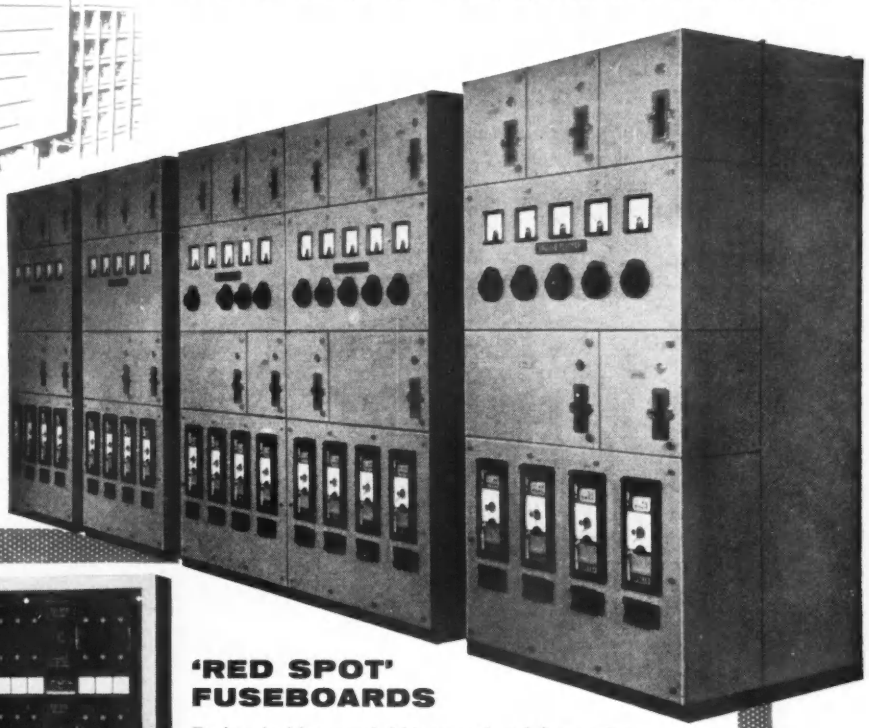

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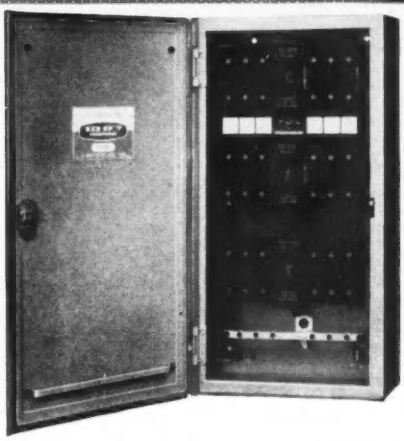

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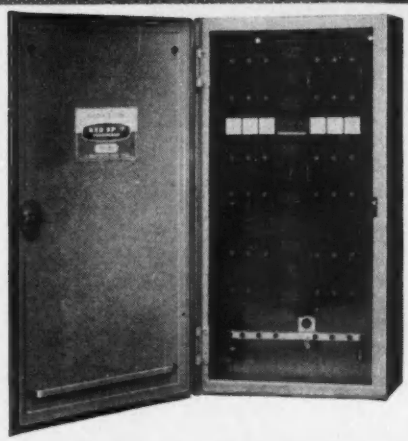

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Designed with concealed hinges and push button door catch having provision for locking by means of a built-in cylinder lock, 'Red Spot' fuseboards have the busbars and incoming cable sockets fully insulated. The fuse contacts and fuse terminals are covered by insulated shrouds. These features provide safety to electrical personnel by enabling spare fuseways to be cabled up with the busbars alive.

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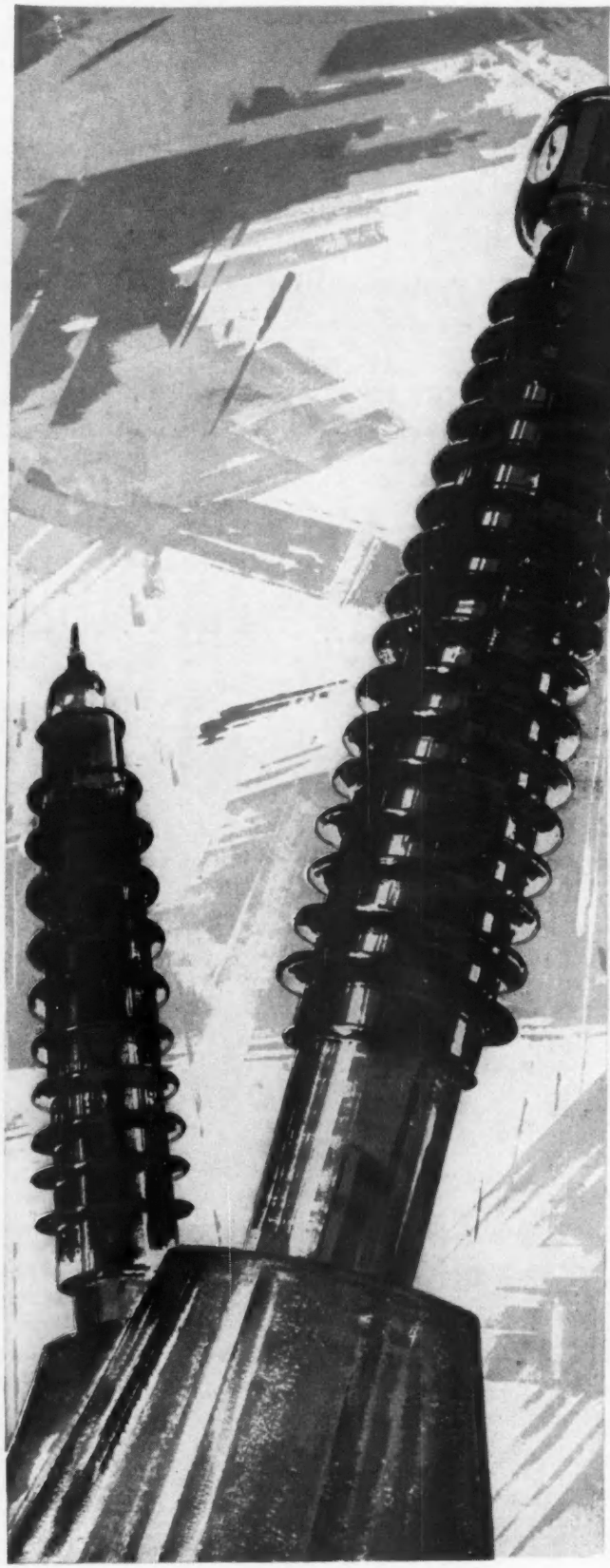

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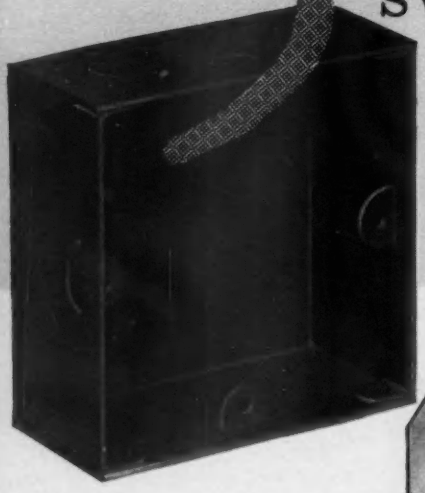

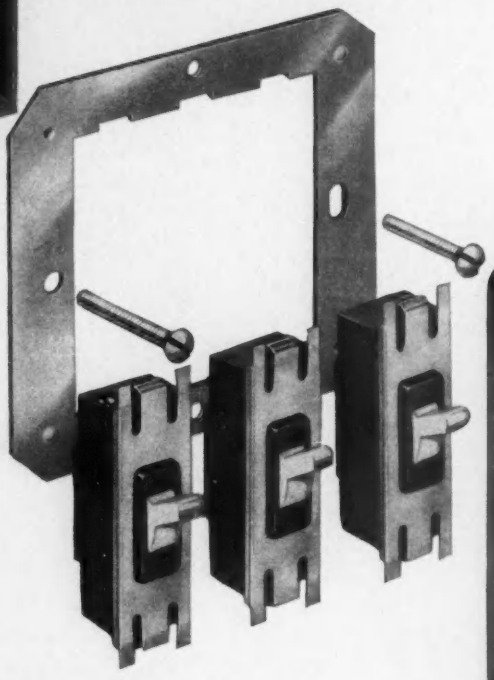

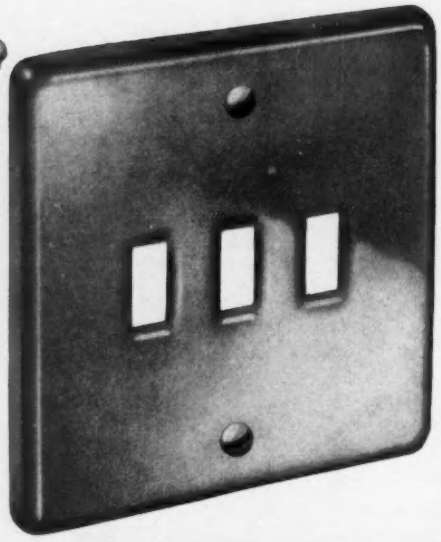

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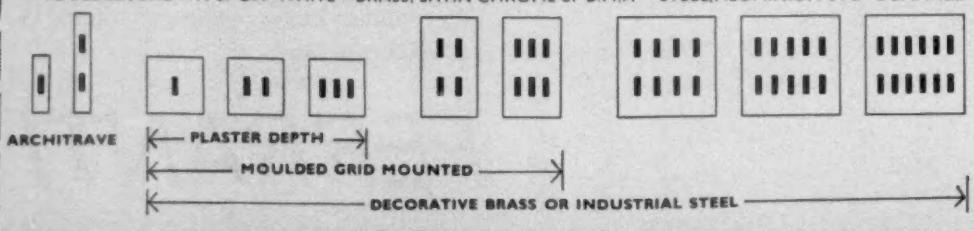

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5 amp 1 way D.P.
5 amp 2 way S.P.
5 amp 2 way & Off
5 amp intermediate
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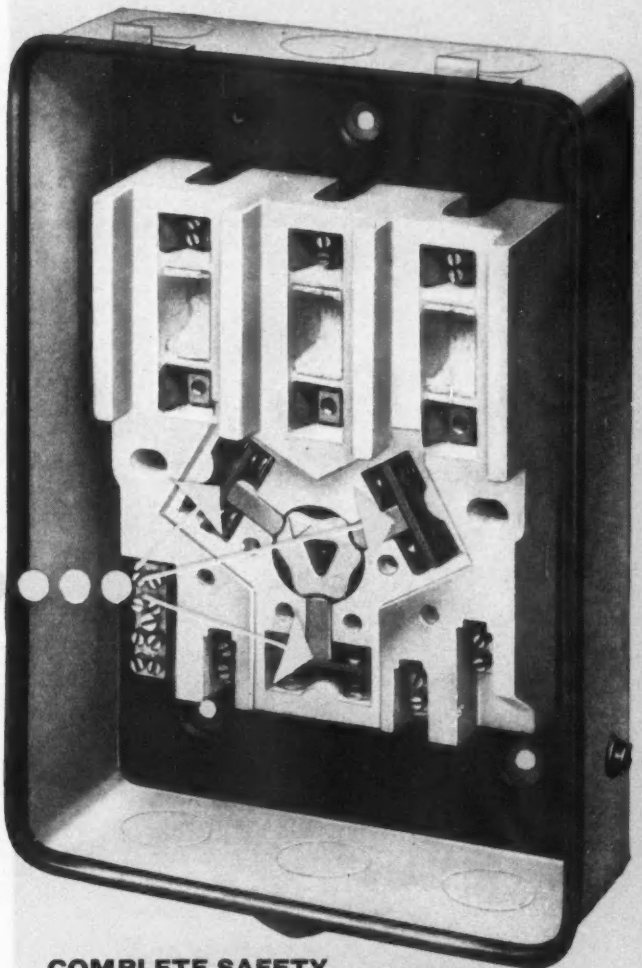

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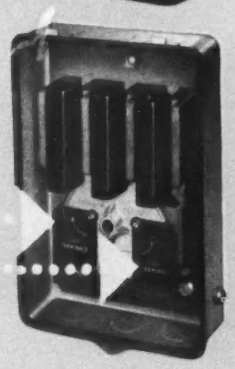

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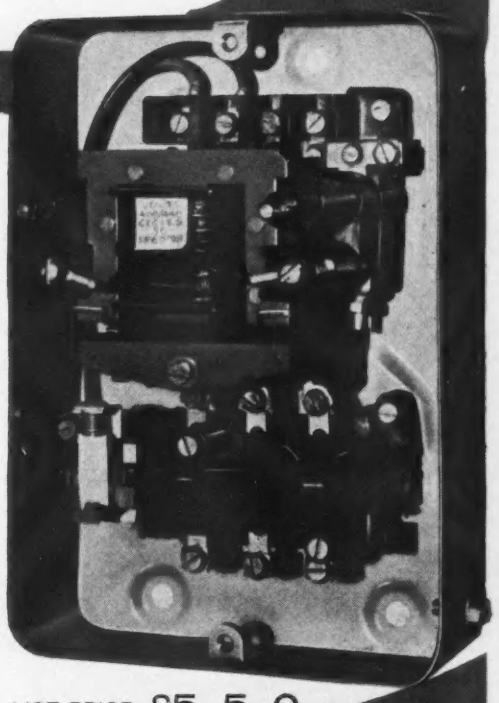

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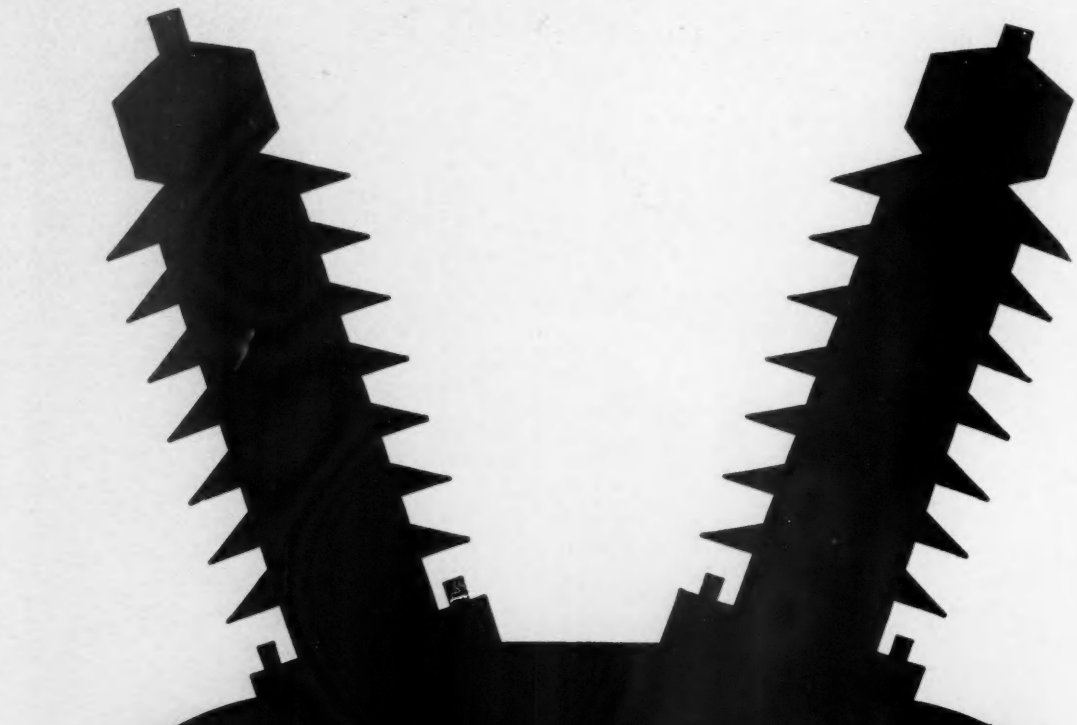

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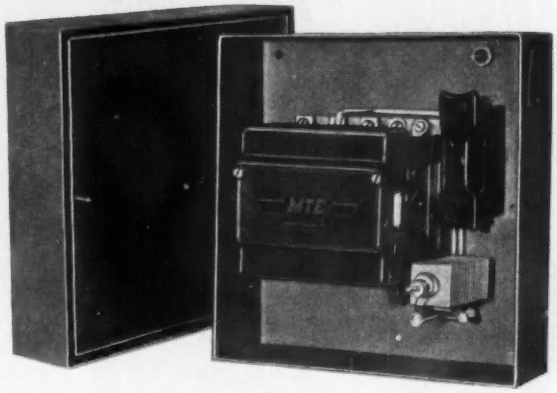

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You want contactors that meet all the requirements of electrical heating circuits and M.T.E. have developed just that. Customer experience, built up over the years, has proved the dependability of M.T.E. contactors – now this special development is being produced to simplify the selection and installation of contactors for heating control.

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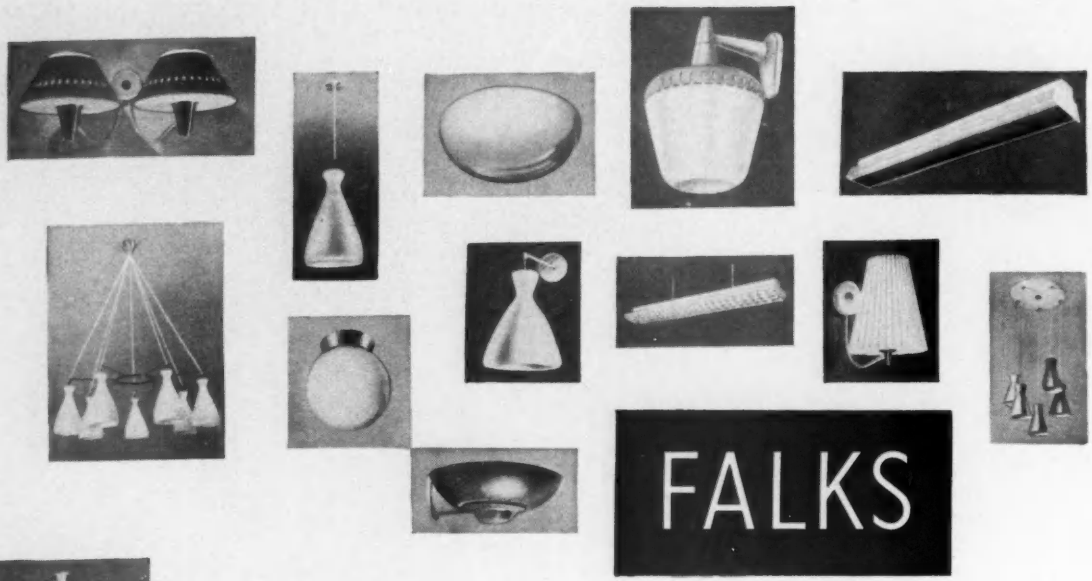

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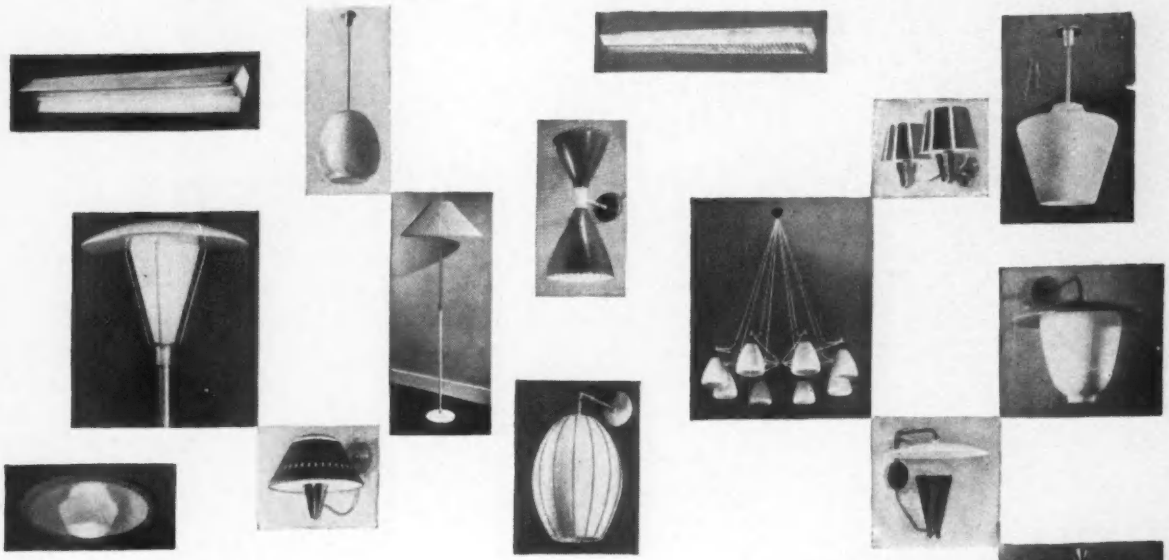

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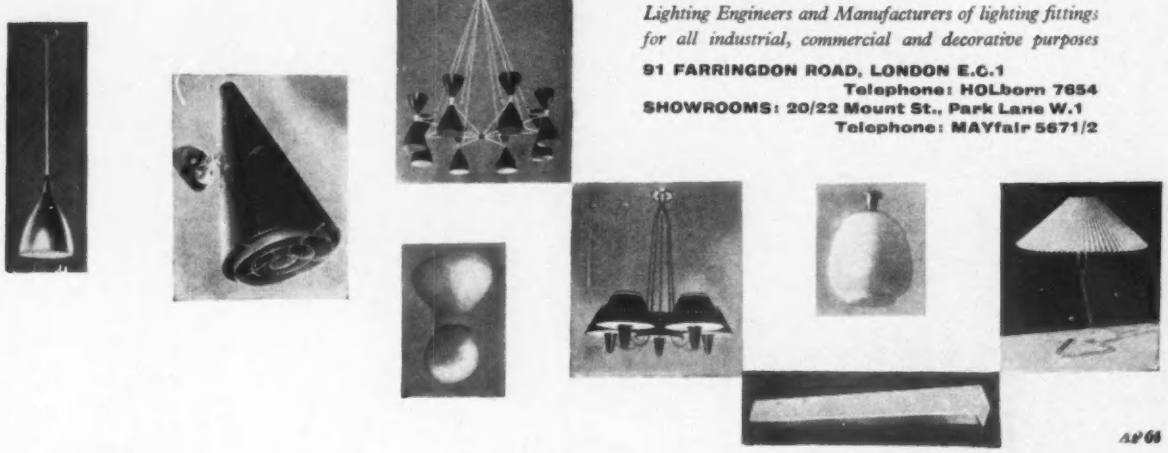

AD 66

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"ZIGOLO" ACSR has 26/.1205" aluminium wires over 7/.0935" steel wires and was selected to obtain optimum economy in line construction and operation.

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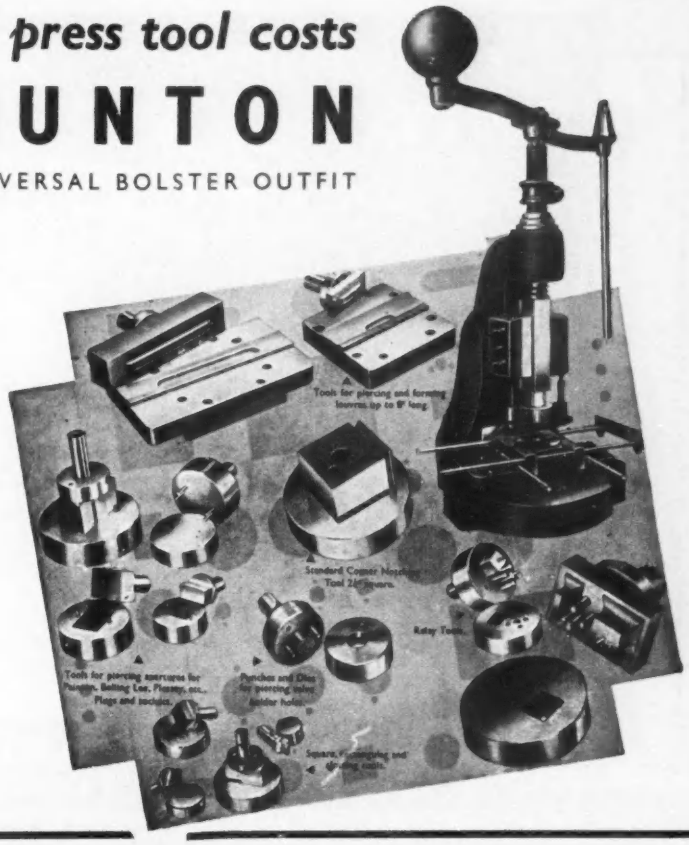

In addition to the range of Punches and Dies ¼" to 3¾" dia. available from stock, some of the tools usually required in the Radio and Electronic Industries have been standardised for use with the Hunton Universal Bolster Outfit. Illustrated here are a few which can be supplied quickly or from stock.

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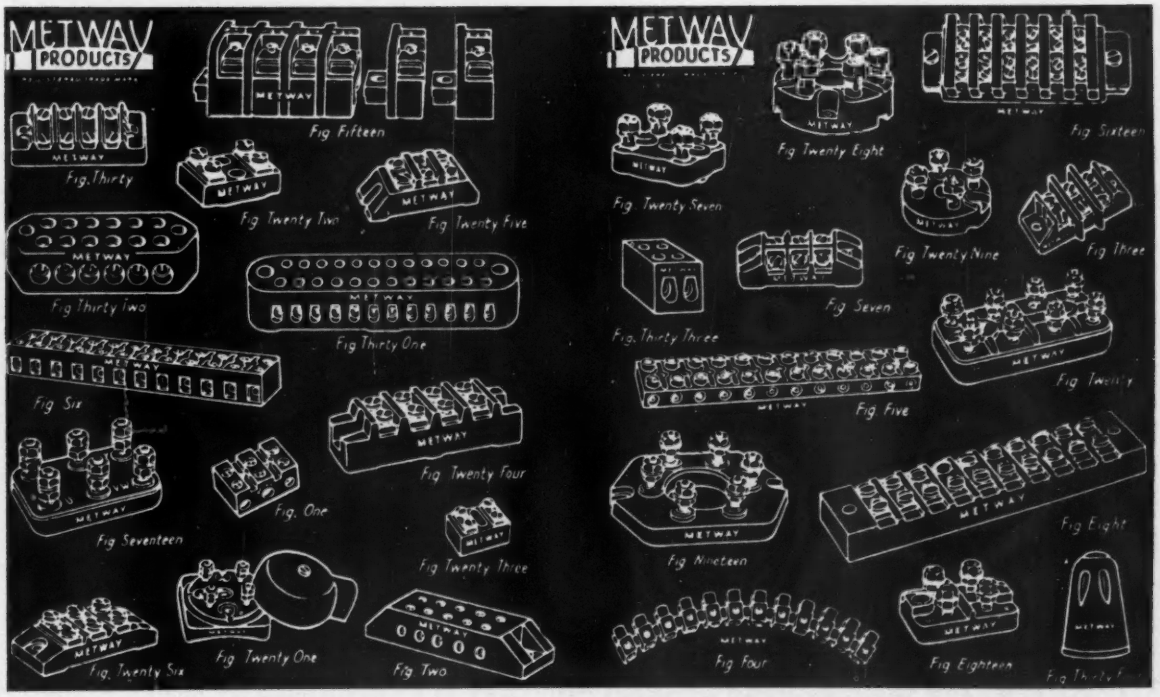

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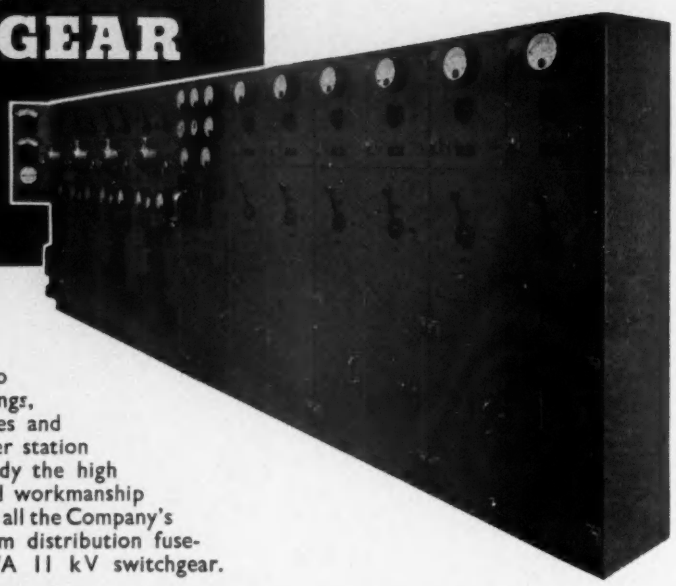

Switchboards of this type have been supplied to hospitals, public buildings, banks, industrial premises and for the control of power station auxiliaries. They embody the high standard of design and workmanship which is to be found in all the Company's products ranging from distribution fuse-boards to 250 MVA 11 kV switchgear.

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THURSDAY 30 MARCH, 1961
Registered as a Newspaper Volume 139 No. 13

ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

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Dans ce numéro

Les capacitеurs et la production de courant d'impulsion 509

On utilise des générateurs à courants d'impulsion formés de grandes baies de capacitеurs pour étudier les propriétés mécaniques et thermiques dés materiaux soumis à une échauffement ou à une décharge électrique subits. Dans la construction de tels capacitеurs, l'inductance doit être reduite au minimum, mais l'effort électrique peut être de cinq a huit fois plus élevé que celui enregistré dans les capacitеurs d'énergie à courant alternatif. Le papier demeure le meilleure de tous les diélectriques, mais certains corps chimiques assurent une marge de sécurité beaucoup plus élevée que le pétrole.

Emploi d'alternateurs sur les véhicules de transport ... 515

Le courant alternatif est en train de remplacer le courant continu dans l'équipement électrique des véhicules routiers et ferroviaires. Il est possible de construire des alternateurs dont le débit est plus élevé, à faible allure, que celui d'une dynamo. L'absence de commutateurs et de balais facilite l'aération, réduit l'entretien et diminue le poids. On peut utiliser des transistors pour la régulation de la tension et des redresseurs au silicium pour la fourniture du courant continue, lequel assure la charge des accumulateurs.

L'électricité dans l'industrie lourde 523

Dans une grande installation industrielle, l'équipement électrique peut representer jusqu'à un cinquième, ou même davantage, du coût global. Il est possible de réaliser des économies appréciables par un choix judicieux de la tension aux bornes, de l'installation de distribution et des appareils redresseurs. Avec l'extension prise par les réseaux de distribution publique, il est rarement économique de produire le courant à l'usine même, à moins d'avoir aussi besoin de la vapeur pour les procédés de fabrication. L'emploi d'une tension plus élevée aux bornes des moteurs permet d'appliquer à des moteurs à courant alternatif d'une puissance de 12.000 chevaux, le démarrage direct sur secteur. Pour les inversions de marche de forte puissance, les redresseurs statiques tendent à remplacer les convertisseurs rotatifs.

In dieser Nummer

Kondensatoren zur Lieferung pulsartiger Ströme ... 509

Generatoren für pulsartige Ströme, die aus grossen Kondensator-batterien bestehen, werden zur Untersuchung der mechanischen und thermischen Eigenschaften von Stoffen verwendet, die plötzlichen Einwirkungen von Wärme oder elektrischen Entladungen ausgesetzt sind. Beim Entwurf solcher Kondensatoren muss die Induktanz niedrig gehalten werden, doch kann die elektrische Belastung 5 bis 8 mal grösser sein als bei Wechselstrom-Leistungskondensatoren. Papier stellt immer noch das beste Dielektrikum dar, jedoch besitzen gewisse Chemikalien eine wesentlich höhere Dielektrizitätskonstante als öl.

Alternatoren für Transportfahrzeuge 515

Die Erzeugung von Wechselstrom ersetzt die Gleichstromerzeugung bei der Stromversorgung von Eisenbahn- und Strassenfahrzeugen. Wechselstromgeneratoren können zur Abgabe höherer Leistung bei geringen Geschwindigkeiten ausgelegt werden als dies bei Gleichstrommaschinen erzielbar ist. Der Fortfall von Kollektoren und Bürstenvorrichtungen erleichtert die Konstruktion des Lüftungssystems, vermindert die Wartungsarbeit und ermöglicht eine Gewichtsersparnis. Zur Spannungsregelung können Transistoren Verwendung finden und zur Lieferung von Gleichstrom beim Betrieb in Verbindung mit Akkumulatoren dienen Siliziumgleichrichter.

Stromversorgung in der Schwerindustrie 523

Bei grossen Industrieprojekten können die elektrischen Anlagen bis zu mindestens einem Fünftel der Gesamtkosten ausmachen. Bedeutende Einsparungen lassen sich durch kluge Wahl der Klemmenspannungen, Schalt- und Gleichrichtungsanlagen erzielen. Mit der Ausweitung des öffentlichen Stromversorgungsnetzes steht die Krafterzeugung am Platz nur selten dafür, ausser wenn Dampf für Verfahrenszwecke benötigt wird. Die Verwendung höherer Anschlusspannungen hat das Anfahren direkt ans Netz angeschlossener Maschinen auch im Fall von 12000 PS Wechselstrommotoren ermöglicht. Bei grossen Wendeantrieben werden Maschinensätze von statischen Gleichrichteranlagen verdrängt.

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ANNOUNCEMENT

British break-through in fluorescent lighting

Atlas are proud to announce a significant break-through by British technicians in the field of fluorescent lighting, bringing a considerable increase in efficiency plus total savings of as much as 25% on the capital and operating costs of larger installations.

Basis of the advance is the development by Atlas of a new 8 ft. 85 watt tube and new low loss control gear which makes the twin 8 ft. 85 watt fitting the best economic proposition for most industrial and commercial lighting purposes.

The 85 watt tube, which incorporates entirely new manufacturing techniques, achieves the considerably high figure of over 80 lumens per watt initial efficiency ('White' colour) and, at the same time, combines long life with the high average efficiency of 74 lumens per watt. The brightness of the tube is much lower than either the 5 ft. 80 watt or 8 ft. 125 watt ratings so that even when no diffusers are employed there is less risk of glare.

The special twin low loss Atlas control gear, developed to operate two 8 ft. 85 watt tubes, consists of only one component, set for 230/240v. It provides a quick and reliable switchless start with total wattage loss for the two tubes of only 35 watts and extremely high power factor of more than 0.95.

Together these advances form the new Atlas Super 8 circuit — designed to operate two 8 ft. 85 watt tubes.

When incorporated with the new Atlas Atlantic 2 fittings, which include many novel design features and a complete range of reflector and diffuser attachments, Atlas Super 8 offers the most advanced fluorescent lighting circuit available today.

atlas super 8
fluorescent lighting circuit

advantages of **atlas super 8** twin 8ft 85 watt tube circuit and fittings over twin 5ft 80 watt tube fittings

25% higher 'lumens per watt' tube efficiency
35% more 'lumens per tube' for same loading
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17% lower surface brightness
15% saving in installation and fitting costs
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25% saving in annual lighting costs

Atlas Lighting Limited Thorn House Upper St. Martin's Lane London WC2

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ELECTRICAL TIMES

ESTABLISHED 1891

THURSDAY, 30 MARCH, 1961

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Comment

TWENTY PER CENT STABILITY

The electrical industry has asked for stability in trading conditions regulated by Government; now this has been agreed to. The industry asked that hire-purchase limitation should be fixed at 10% initial deposit instead of the present 20%; that has been refused. Thus, the major efforts of BEAMA and DAD have ended in a pyrrhic victory; stability not at a level considered desirable in the interest of trade, but stability because it has the convenience of no-change. Experience over the past two years has proved that hire-purchase control is a clumsy tool for regulating internal economic pressures. The Treasury has more delicate instruments to hand for such purposes and perhaps wisely feared that any change in rate of initial deposit might again set up hunting between boom and slump in consumer durables. Only six months ago the Government was claiming the retention of hire-purchase control as an economic weapon. Now the Board of Trade has told the industry of its recognition of the need for stability. But if and when the required economic regulation is outside the limit of the fine rheostat who is to gainsay the use of the coarser control of hire-purchase? For the present, however, the industry is assured of stability in hire-purchase terms, though, with the Budget in the offing, that other regulating device, purchase tax, is up for consideration. Economic pundits are urging a fiscal swing from direct towards indirect taxation, and although few believe the Chancellor will go so far as to impose a general sales tax, the whole question must be very much in the melting pot. With the high purchase tax rates already applying to domestic appliances there should be little cause for apprehension; but the situation leaves one more uncertainty for manufacturers to face.

TROUBLE IN TRANSFORMERS

The judgement of the Restrictive Practices Court on the Transformer Manufacturers' Agreement represents a serious rout for many of the trading principles on which the electrical industry's high quality of product and fine export record has been built. All the arguments presented by the manufacturers were rejected by the Court in a judgement which advances arguments that read strangely in the light of experience in other sections of the electrical industry. If the three-man Court is correct in its prediction of the future, loss of co-operation between manufacturers will in some ways work to the advantage of electrical exports; the nationalised industries will prove not to be keen bargainers; research and development expenditure will continue as at present, even though prices and presumably profits will fall from their present levels; and finally, even if technical co-operation ceases, quality

of design and technical progress by individual manufacturers will remain unaffected. These are the qualities of an Alice in Wonderland electrical industry; the 1961 reality presents a more alarming prospect. In the face of the judgement, transformer manufacturers can easily choose to proceed to a price war, and then further amalgamations; but that is unlikely to be the solution best for the industry or for the country. A big effort is now needed to maintain rational pricing, and avoid the chaos that has been experienced in other parts of the industry. To achieve this within the hampering provisions of the RTP Act will demand the highest industrial statesmanship from everyone involved, large buyers of transformers as well as manufacturers.

USING THE CHARTERED ENGINEER

Last week's Engineers' Guild organised conference on the employment and development of the professional engineer had as its background official predictions of a shortage of engineers in the immediate future. If there is a shortage, then it is important that the best use be made of the engineers who are available. Those who spoke in the discussion of last week's papers were much preoccupied with the important questions of remuneration and promotion prospects; but there are other aspects of the subject which are equally vital. Probably the most urgent is that of getting across to employers of engineers what today's newly qualified chartered engineer represents in potential and how he differs from his pre-war predecessor. If education and training are matching the intentions of the professional institutions, then the emerging professional engineer has a capability of analysis of existing problems and of synthesis of improving solutions as an outstanding characteristic. It is wasteful to keep such a man on a job that has become routine, although it may be rewarding to put routine jobs in the hands of professional engineers on occasion to see how the routine can be refurbished. There are engineers outside the "professional" ranks—distinguished in today's jargon as technicians—and it is economic sense to give them the routine work, the line job and the established technique. It is probable that only a small proportion of employers of engineers are really aware of the changes in nomenclature that are reflected in these considerations. Until they are brought face-to-face with the new situation they are certain to waste the professional engineer. To get that truth over seems a task in which the institutions can properly join, as well as the Engineers' Guild.

INDUSTRIAL SWITCHGEAR

Switchgear manufacturers may smart under the heavy criticism they receive in Sir Henry Clay's paper to the ASEE on large electrical installations, but at least they will welcome his self-criticism. He thinks industrial switchgear is too expensive because there are too many manufacturers, but, on the other hand, he confesses that it is the "fads about special features" which consultants and works engineers have that militates against more standardisation. The switchgear market is inevitably of considerable technical complexity, and difficulties about standardisation are probably related to the number of firms operating, for willingness to meet the whims, possibly expensive, of the customer is more prevalent where competition is sharp. Sir Henry makes his own contribution to standardisation by dismissing boldly the claims of oil circuit-breakers for industrial use at voltages of 11 kV and below. Their days may be numbered, but it will be many a year before they cease to concern the works engineer. Yet the trend away from liquid dielectrics stands out throughout the industrial engineering field. It is apparent in the fast-extending use of air breakers and in the way the miniature circuit-breaker at industrial powers is finding increasing application on economic grounds. In transformers, also, the development of higher temperature insulating materials has brought the dry transformer into prominence as a corollary of air-break switchgear in giving substations of low fire risk. All this means new thinking for designers of industrial installations, thinking that has to be matched by the design and production of switchgear firms.

WHOLESALING EFFICIENCY

Throughout Europe the trend in trading is to erode the discount structure that pays the wholesaler for his services. Legislation and the pressure of intensifying competition both work in that direction. How, then, is the electrical wholesaler to maintain and improve the position he established in a different climate of trading practice and public opinion? At the Electrical Wholesalers' Federation annual dinner last week, visitors from the Continent showed that they faced similar problems to those of their British colleagues. On both sides of the Channel, however, there is confidence that electrical wholesalers have a part to play in increasing the efficiency of the electrical industry. They are working to improve their ability to carry out that task. Efficiency is the focus of interest in this drive; a concept perhaps less precise in trading than in engineering, yet one which usefully indicates an attitude of mind, a search for parameters by which shortcomings in performance can be revealed. The trend of legislation to outlaw still further trade agreements and resale price maintenance practices, or of indifference by manufacturers as to whether discount structures are maintained, is only to be countered if it can be demonstrated clearly that wholesalers are important both to manufacturers and to retailers; to the healthy economic situation of the electrical trade, in fact. The EWF is clearly working to effect that persuasion, and its course is paralleled by sister associations in other European countries.

Meteor

This week's quick summary of electrical news faces advertisement page 8

Capacitors for impulse-current generators

by S. C. Chu,* B.Sc.(Eng.), A.M.I.E.E.

LARGE capacitor banks are becoming of increasing importance as energy-storage devices in addition to their use in power frequency circuits. These devices are required to give a rapid discharge for producing a current or a voltage impulse.

In the impulse-voltage generator, discharges simulating lightning, switching and other transient phenomena are produced with a variety of wave shapes which depend on the circuit parameters. An impulse-voltage generator consisting of a number of capacitors which recharge in parallel and subsequently discharge in series is used to produce a very high-voltage impulse. As the discharge circuit has a high impedance, the discharge current is low.

Impulse-current generators generally consist of a number of capacitors arranged in parallel and discharged into a common discharge path of low impedance. They are used for testing apparatus and materials that may be subjected to mechanical forces resulting from rapid heating or current surges, and also for investigating the transient effects of lightning and features of high-current spark discharge in gases. Large capacitor banks have also been used recently for producing very high temperatures and pressures, by means of an electric arc, in a wind tunnel for testing aircraft.

Thermonuclear Research Applications

The most important large-scale use of impulse-current capacitors is in connection with research on controlled thermonuclear reactions.[1] Detailed description of such applications is beyond the scope of this article, but their requirements are so important as to require mention.

In the apparatus "ZETA," the very high temperatures required to produce a thermonuclear reaction are obtained by passing a very large current through ionised deuterium gas—a heavy isotope of hydrogen—which heats the gas and also produces a "pinch" effect due to the intense magnetic field around it. The gas itself forms a single secondary turn of a transformer. The current discharge from the capacitor banks is applied to the primary winding of the transformer. The circuit resonates at a frequency determined by the capacitance of the bank and the leakage inductance of the transformer, which are the two main parameters of the circuit.

In an alternative method, a very fast discharge, i.e., a rapid "pinching" known as "cylindrical shock heat compression," is employed. The electrical circuit is designed to give a low inductance, thus obtaining a very high rate of rise of the discharge current, which is of the order of a number of T-amperes per second (TeraA=10^{12}A). Capacitors are used for large-scale energy storage in preference to other devices because of their economy and flexibility in energy transfer.

A simple test circuit with constant parameters is assumed for analysis. Although most of these circuit parameters are actually distributed, they can usually be closely approximated to a simple series, L, C and R arrangement according to the equivalent circuit shown in Fig. 1a.

The surge current and its wave shape after the gap breaks down are derived from the solutions of a well-established second order linear differential equation.

For a critically damped circuit in which the critical resistance $R_1 = 2\sqrt{L/C}$, the wave shape of the current and voltage is unidirectional.

$$\text{Thus } i = -E_0 t/L . \exp[-R_1 t/2L] \quad .. \quad .. \quad .. \quad (1)$$

The negative sign indicates that the voltage and the current are opposite in phase.

$$E = E_0 (1 + R_1 t/2L) \exp[-R_1 t/2L] \quad .. \quad (2)$$

$$t_p = \sqrt{LC} = \tfrac{1}{2} CR_1 \quad .. \quad .. \quad .. \quad .. \quad (3)$$

$$i_p = E_0/e\sqrt{C/L} = 2\pi f C E_0/e \quad .. \quad .. \quad .. \quad (4)$$

$$f = 1/(2\pi\sqrt{LC}) \quad .. \quad .. \quad .. \quad .. \quad (5)$$

$$Q_1 = \tfrac{1}{2} \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (6)$$

where: C = combined capacitance of capacitor bank and load
e = Naperian base = 2·718
E = Instantaneous voltage across capacitor bank
E_0 = initial voltage across capacitor bank after charging
f = natural frequency
i = instantaneous current
i_p = peak current
L = combined external and internal series inductance
Q_1 = Q-factor at critical damping. Q-factor is the reciprocal of the overall circuit power factor, alternatively defined as the ratio of the circuit inductive reactance to effective resistance
R = combined external and internal series resistance
R_1 = critical resistance
t = time in seconds after gap breaks down
t_p = time in seconds for peak current to occur.

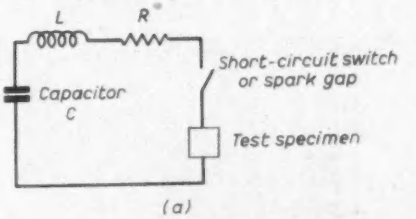

Fig. 1 (a). Equivalent circuit for impulse-current generator with constant parameters

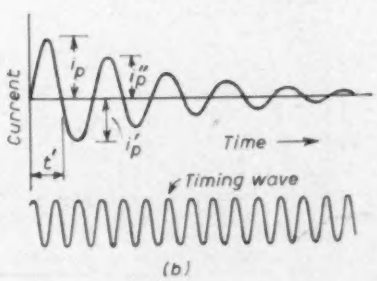

Fig. 1 (b). Oscillatory discharge of capacitor with $R < 2\sqrt{L/C}$

decrement, d,

$$= \frac{i'_p}{i_p} = \frac{i'_p + i''_p}{i_p + i'_p}$$

* Mr Chu was formerly with Standard Telephones and Cables Ltd. and is now with Enfield-Standard Power Cables Ltd.

In the oscillatory discharges as shown in Fig. 1b, where $R < 2\sqrt{L/C}$, the surge current and voltage, etc., are:

$$i = -2E_0/P \exp[-Rt/2L] \sin Pt/2L \quad .. \quad .. \quad (7)$$

$$E = E_0 \exp[-Rt/2L] (\cos Pt/2L + R/P \sin Pt/2L) \quad (8)$$

$$t_p = \sqrt{LC}\,(1 - 1/r^2)^{-\frac{1}{2}} \sin^{-1}(1 - 1/r^2)^{\frac{1}{2}} \quad .. \quad (9)$$

$$i_p = E_0\sqrt{C/L}\,F(r) = 2\pi fCE_0F(r) \quad .. \quad .. \quad (10)$$

$$f = \sqrt{(1 - 1/r^2)}/(2\pi\sqrt{LC}) \approx 1/(2\pi\sqrt{LC}) \quad .. \quad (11)$$

and $$d = \exp[-Rt'/2L] \approx \exp[-\pi/\sqrt{4Q^2-1}] \quad .. \quad (12)$$

where $P = \sqrt{4L/C - R^2} = 2\sqrt{L/C}\,(1 - 1/r^2)^{\frac{1}{2}}$

Q = Q-factor of oscillatory discharge

t' = duration of one half wave $= 1/(2f)$

d = decrement of oscillations, i.e., ratio of the amplitude of successive half waves

r = ratio of critical to actual resistance

$= R_1/R \approx Q_1/Q \approx 2Q$

r is usually of an order greater than 10

$$F(r) = \exp\left[\frac{-1/r \sin^{-1}(1 - 1/r^2)^{\frac{1}{2}}}{(1 - 1/r^2)^{\frac{1}{2}}}\right]$$

F(r) is usually between 0·85 and 0·95 for surge current circuit of normal construction without added resistance[2].

For a given initial energy, i.e., C and E_0, the main requirement is that L should be as small as possible in order to obtain the highest value of peak current.

The maximum rate of rise of current for capacitor discharge occurs at the instant when the circuit is closed. It is equal to the capacitor charge voltage divided by the circuit inductance:

$$di/dt = E_0/L \quad .. \quad .. \quad .. \quad .. \quad .. \quad .. \quad (13)$$

A comparison of i_p in equations (4) and (10) shows that, for critical damping, the capacitor should be charged to a much higher voltage in order to obtain the same value of i_p than in the oscillatory case. It is also interesting to note the resemblance between the expression for i_p and that for the conventional capacitor current at power frequencies.

It can also be seen from equation (12) that, with a constant L, the amplitudes of successive half waves of oscillation decrease exponentially at a rate dependent on resistance R. That is, the higher the value of R (i.e., lower Q-factor) the more rapidly is energy dissipated and the faster the oscillations die out.

Curves of decrement of oscillations and exponential factor, F(r), are plotted against r in Fig. 2, which can be used to evaluate the peak current by equation (10) from the natural frequency and the decrement of oscillations obtained from tests.

Impulse-current Capacitor Design

The rating of an impulse-current capacitor is usually expressed in joules, i.e., in microfarads at a particular voltage.

It can be shown that:

$$\text{Joules} = Wg^2\epsilon \times 7{\cdot}25 \times 10^{-7} \quad .. \quad .. \quad .. \quad (14)$$

where W is the effective volume of the dielectric in cubic inches, that is, excluding the dielectric volume beyond the foil edges; g is the average electric stress in the dielectric in kV/cm and ϵ is the permittivity.

Thus, for a given quantity of stored energy, the effective volume of a given dielectric required is inversely proportional to the square of the electric stress and the dielectric permittivity. Therefore, in order to reduce the physical size of a capacitor for a given energy output, it is necessary to increase g and ϵ as much as possible, which is also the case in power frequency capacitors for a given kVAr.

So far, impregnated paper remains practically unrivalled as a dielectric for power capacitors. The dielectric thickness required is primarily governed by its d.c. and impulse strengths. The impulse strength of paper varies with its apparent density and air impermeability, and this variation is more marked with the lower viscosity impregnants.

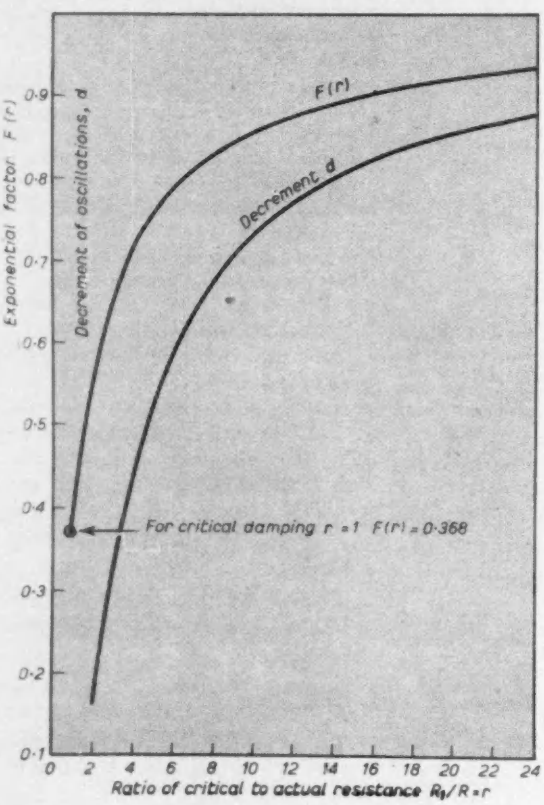

Fig. 2. Decrement of oscillation and exponential factor as a function of critical to actual resistance in an oscillatory discharge circuit

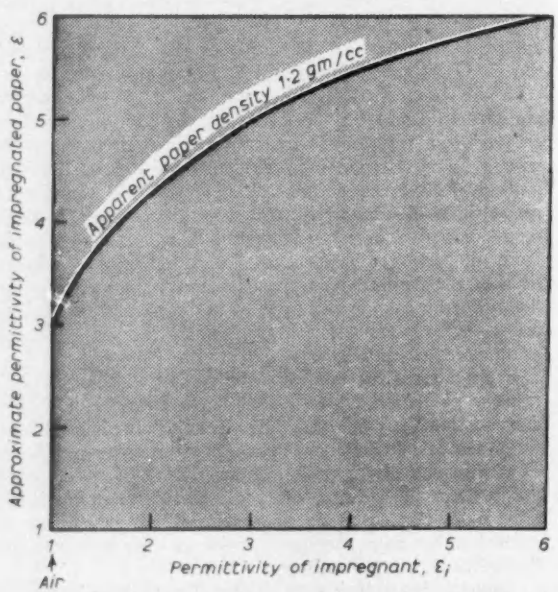
Approximate permittivity of impregnated paper, ε
Apparent paper density 1·2 gm/cc
1 2 3 4 5 6
Air
Permittivity of impregnant, ϵ_i

Fig. 3. Approximate relationship between permittivity of impregnated paper and impregnants. Based on permittivity of cellulose fibre = 6 and density 1·5 gm/cc

The type of paper and impregnant used also affects the permittivity of the composite dielectric. Fig. 3 shows the relationships between the permittivity of impregnated paper and that of the impregnant.

The use of thin paper increases the dielectric d.c. and impulse strengths. However, the cost of capacitor paper increases rapidly with the reduction of thickness as shown in Fig. 5, especially below 12 microns. For a given working voltage, the use of thick insulation will reduce the number of elements in series, thus simplifying the construction by reducing the number of internal connections. However, thick insulation reduces the ionisation inception stress. The design of the capacitor is therefore a compromise.

The use of high permittivity impregnants will increase the effective permittivity of the impregnated paper dielectrics, thus saving material. The permittivity of the composite dielectric should also be stable over the temperature and frequency range at which the capacitors are discharged. Suitable impregnants of high permittivity for power capacitors are chlorinated diphenyl, castor oil and dibutyl sebacate, with permittivities of 4·5 to 6·0 as compared with 2·2 to 2·4 for oil. The successful application of these impregnants depends very much on the method of processing and the type of paper used. The use of chlorinated diphenyls for a.c. capacitors in England has increased considerably during recent years. Castor oil and dibutyl sebacate have been used in the USA for d.c. and high frequency capacitors, respectively. Both petroleum jelly and castor oil have recently been used in impulse-current capacitors in this country.

The insulation resistance/temperature and viscosity/temperature characteristics of the impregnant may also influence the life/temperature performance of the capacitor.

Electric Strength

The design stress employed in impulse-current capacitors is higher than that used in a.c. capacitors in the ratio of from 5:1 to 8:1, being higher for unidirectional discharges. As a rough comparison of the physical sizes, taking a design stress of, say, six times that of an a.c. capacitor, an impulse-current capacitor with a stored energy of 1,500 joules has approximately the same effective volume of dielectric as a 26 kVA a.c. capacitor for similar voltages.

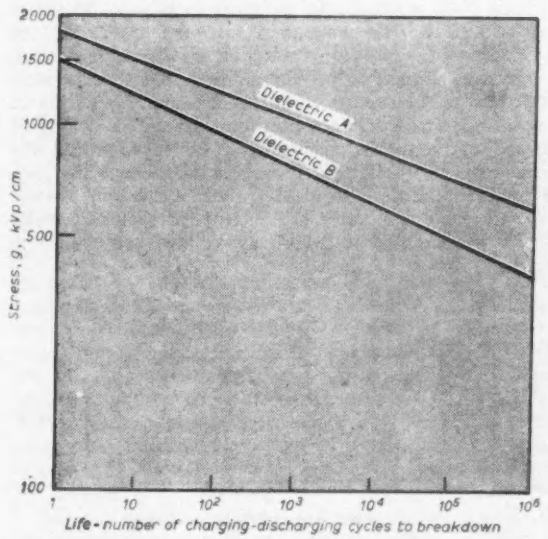

Fig. 4. Illustrating the stress-life relationship for capacitors subjected to oscillatory discharges

The justification for employing these high stresses are: First, overvoltages in impulse-current capacitors during service are rare, while a.c. capacitors have to withstand transient overvoltages due to frequent switching. Secondly, impulse-current capacitors have much reduced dielectric losses. The losses in a.c. capacitors, which increase with the square of the applied voltage, i.e., the square of the electric stress, govern the temperature rise of the capacitor.

Operating Temperature and Stress

The operating temperature must not be allowed to exceed a safe maximum in order to ensure thermal stability. In impulse-current capacitors, the thermal capacity of the foil, paper and impregnant is sufficient to limit the temperature rise provided the rate of recurrence of discharge is within a reasonable limit. Thirdly, the ionisation characteristics of impulse-current capacitors are quite different from those of a.c. capacitors. It can be said that under the same stress conditions, ionisation in the former is much less severe.

The actual design stress will depend on the specified requirements for overvoltage and life tests. Under similar test conditions on a particular design of capacitor, i.e., similar testing natural frequency, decrement of oscillations and rate of charging-discharging operations, the relationship between the logarithms of the life, in terms of number of charging and discharging cycles, and that of the voltage stress is approximately linear as shown in Fig. 4, A and B being dielectrics with different instantaneous d.c. breakdown stresses, which are plotted at unit charging-discharging cycle on abscissa. For unidirectional discharges, the life is considerably longer than for oscillatory discharge with the same peak stress.

Self-inductance and Resistance

Two important factors control the self-inductance of a capacitor. The first is the ratio of length of a capacitor element to its diameter (or its equivalent diameter in the case of a flat element). For cylindrical elements, the inductance can be approximated by a well-established formula by assuming the two foil electrodes to be representable as hollow tubes.

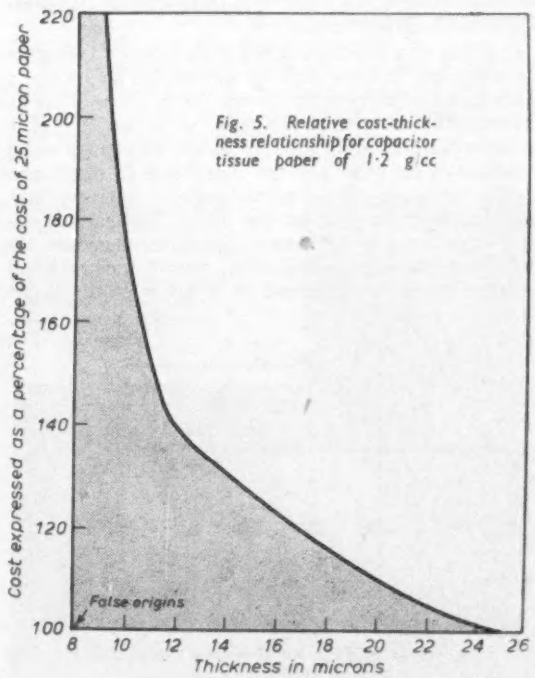

Fig. 5. Relative cost-thickness relationship for capacitor tissue paper of 1·2 g/cc

Thus: Inductance=$2s \log_e D/d$ millimicrohenrys (i.e., 10^{-9} henrys) .. .. (15)

Where s=length of elements in cm, D=outside diameter and d=average diameter of the element, both in the same units. The method of positioning and connecting the foils, for example, whether projecting or non-projecting foils are used, also has some effect on the inductance. For a given value of capacitance, a short element with a large number of turns will have a lower inductance than a long, slim element with fewer turns.

The second factor is the dimensions and arrangement of terminals, case and internal connections. When two terminals are used, they should be as close to each other as possible to keep the inductance between them to a minimum. If both terminals are insulated from the metal container, the effect of the latter on the inductance of the capacitor is negligible. The coaxial type of terminal is to be preferred and its insulation and length are kept to a minimum to give a minimum inductance. In this case, the metal container forms part of the path taken by transient current during discharges. The inductance of the capacitor is then influenced by the proximity of the container to the elements and the position at which the internal connection to the container is made.

The series resistance of the capacitor depends on the thickness of foil used and the method of connection. As in the case of inductance, the series resistance is reduced by paralleling the foil ends. When inserted contact strips are used, the effective resistance depends on their number and position.

The inherent inductance and resistance of a capacitor form a series resonant circuit with the capacitance when the unit is short-circuited. The frequency at which the capacitor impedance is a minimum (i.e., inductive reactance =capacitive reactance) is known as the natural or self-resonant frequency.

Ionisation Caused by Transients

The mechanism of breakdown by a.c. ionisation is now well established, but, so far, ionisation due to transients has not yet been fully studied.

According to a published article,[3] the internal ionisation in a capacitor during transient conditions is mainly a surface-creepage phenomenon at the foil edges and can be represented by an equivalent circuit, as shown in Fig. 6. The capacitance C_s and resistance R_s are distributed along the surface of the paper and the capacitance C_p distributed through the paper. The diagram neglects the very high insulation resistance through the paper. The gaps across the series capacitance C_s produce the effect of making the dielectric conducting by ionisation, thus the potential of the paper surface is dispersed by a series of discharges through the gaps.

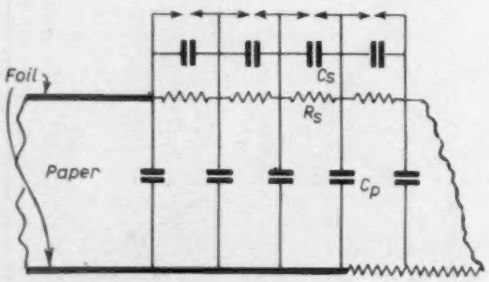

Fig. 6. Equivalent circuit for a capacitor dielectric at the edges of the electrodes

When a direct voltage is applied to a capacitor dielectric, a space charge flows into the dielectric through the resistance R_s. If the direct voltage is increased slowly, the potentials of the capacitance C_p closely follow the foil potential and no appreciable potential develops across C_s. Similar conditions apply when the capacitor is discharged slowly. Ionisation will not, therefore, occur, since the gradient in the dielectric near the foil edge is very small and any space charge will leak through R_s and back to the foil. If the capacitor is discharged rapidly, a potential appears across C_s which may cause breakdown. A series of breakdowns will then occur through the gaps along the paper surface at the edge. The voltage across C_s increases with the natural frequency of the transient. Thus, internal ionisation at the foil edges during transients depends on:

(1) The peak-to-peak voltage swing during the oscillations;

(2) The natural frequency of the transient; and

(3) The rate of recurrence of the transient, i.e., the length of the rest period between successive charging-discharging operations.

Testing

The usual routine tests employed on a.c. power factor correction capacitors are also applicable to impulse-current capacitors. They consist of applying an over-potential between the terminals and/or between the terminal and the container, and measuring capacitance, insulation resistance and power factor at specified voltages and frequencies.

There are also special tests applied to impulse-current capacitors which may be considered as type tests. These are the inductance measurement and life tests.

Although inductance of the capacitor elements can be approximated by formula as discussed before, the inductances of the internal connections and the terminals cannot be accurately calculated. Therefore, the actual value of the inherent inductance of a complete capacitor should be measured in order to obtain empirical data for future design basis. This is determined by measuring the natural frequency of the circuit during short-circuit of the capacitor by transient tests. The capacitor is charged to a suitable direct voltage, usually a few kV, and discharged through a non-inductive shunt or the primary of a mutual inductor which is connected at the earth end of the circuit. If a shunt is used it should be designed to have a minimum time constant. The voltage across the shunt or the secondary of the inductor, caused by the discharge current, is measured with a c.r.o. Alternatively, the voltage wave shape across the capacitor can be measured by means of a resistance or capacitance potential divider. Recording of current or voltage transients can be taken when the capacitor is short-circuited through a switch or spark gap. In practice, the time required for the current or voltage wave to reach peak value is sufficient for a pick-up aerial (which has been used in impulse-voltage generators) to trip the c.r.o.

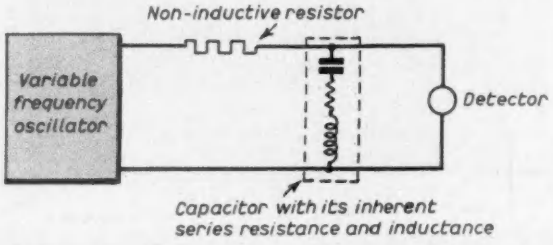

Fig. 7. A.C. test circuit for measuring the inductance of a capacitor

The natural frequency of the circuit is determined by comparison with a timing wave. (See Fig. 1b.) Short external connections should be used to reduce the extra inductance introduced. Another method of measuring the inductance of a capacitor is by steady-state tests with a.c. Measurement is made with a variable frequency oscillator, using an attenuator if necessary, and a suitable detector or valve voltmeter, as shown in Fig. 7. The frequency at which the impedance is a minimum is the self-resonant frequency of the capacitor. The actual value of the impedance can be obtained by using a known non-inductive resistance for comparison. However, since the self-resonant frequency is required, the actual value of circuit impedance is not important.

The inductance of the capacitor is calculated by the formula $L=1/(4\pi^2f^2C)$. For example, a capacitor of 1 microfarad with a self-resonant frequency of 503 kc/s has an inductance of 100 millimicrohenrys; and 150 millimicrohenrys with 400 kc/s.

Life Test

The life of an impulse-current capacitor is tested by short-circuit discharges at a particular voltage and with voltage swings at a frequency equal to or less than the self-resonant frequency of the capacitor. Suitable values of external resistance and inductance may be added in order to give the required natural frequency and the decrement of oscillation for the test circuit. Calibrations of frequency and decrement are based on recorded oscillations already described. The peak current generated can be evaluated by equation (10) and Fig. 2.

For example, if a wave form obtained from the oscillogram shows a frequency of 415 kc/s on a capacitor of 1 microfarad, discharged at an initial voltage of 50 kV, with a decrement of 0·85, then r and F(r), obtained from Fig. 2, are 19·5 and 0·921, respectively. The calculated peak current by equation (10) is 120,000 A.

The test circuit for short-circuit discharges is similar to that of Fig. 1, with the addition of suitable charging, measuring and protective devices. The capacitor can be short-circuited either by a suitably timed mechanical device or by electrical tripping, using spark gaps. In the latter case, irradiation of the gaps can be applied to reduce any irregularities and so ensure sparkover at the required voltage.

Conclusion

An attempt has been made in the present paper to discuss the various electrical design features of capacitors suitable for impulse-current generators, as distinct from those for conventional power factor correction capacitors, with particular reference to self-inductance and test methods.

While published experimental data and service experience on this type of capacitor is very meagre, it seems likely that it will have increased applications in a variety of development and research work in the future.

The author wishes to thank Standard Telephones and Cables Ltd. for permission to publish this paper.

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2. Durnford, J., and Reynolds, P.: "Generation and Measurement of Oscillatory Current Impulses up to 470 kA," Proceedings IEE, 1954, Vol. 101, Pt. IV, p. 1.
3. Nye, J. R., and Wilson, W. R.: "Physical Concepts of Corona in Capacitors," Trans. AIEE, 1953, Vol. 72, Pt. III, p. 781.

Exhibition Awards and Attendances

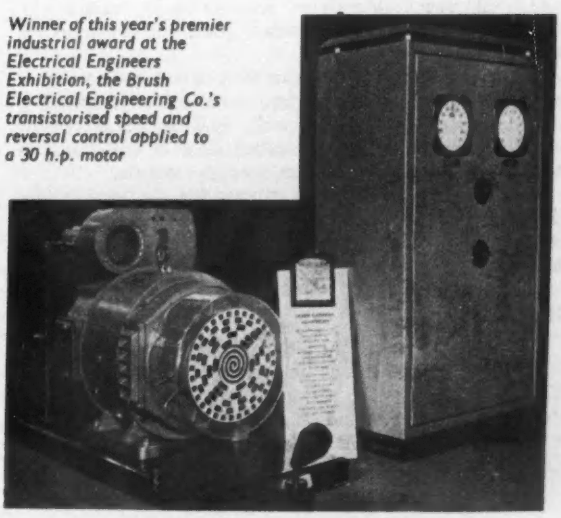
THE full list of awards for the year's outstanding industrial and domestic appliances exhibited at the Electrical Engineers Exhibition are as follows.

Industrial: Silver plaque to Brush Electrical Eng. Co for their 30 h.p. speed-controlled motor with static rectifier supply for armature and field current governed by a closed-loop servo-mechanism incorporating a transistorised control amplifier. The Ferranti on-load tap changer for three-phase transformers up to 33 kV was highly commended.

Domestic: The silver plaque to Easipower Appliances for their "Dreamland" three-heat luxury electric blanket of flameproofed fleece rayon in two colours. Heatrae's decentralised electric warming system was also highly commended. A brief reference to these awards was made last week. Viewed in retrospect, the exhibition can again be called an unqualified success. The social events were well attended; in particular, the opening luncheon, where 485 guests, from home and abroad, sat down to make the largest gathering ever to attend an exhibition luncheon at Earls Court. Visiting parties from abroad included groups from China, France, Sweden and the Soviet Union. In the latter party were to be seen four women electrical engineers, one of whom, Mrs Dmitrenko, said that about half of the electrical engineers in Russia are women.

Among orders received by exhibitors during the exhibition was one for a £20,000 mobile oil-filtration plant, placed by Gulf Oil (Gt. Britain) Ltd. with Streamline Filters Ltd., and another was for two radar fault locators to detect ice build-up and conductor oscillation on 132 kV and 275 kV transmission lines, placed by the Scottish Electricity Boards with Ferranti.

As the exhibition closed it was announced that a preliminary count showed attendances to be slightly up on last year at about 75,000, this figure including more than 800 overseas visitors from 88 countries.



Winner of this year's premier industrial award at the Electrical Engineers Exhibition, the Brush Electrical Engineering Co.'s transistorised speed and reversal control applied to a 30 h.p. motor

Transformer Trouble

PRICE AGREEMENTS CONDEMNED BY RESTRICTIVE PRACTICES COURT

TRADE agreements between members of the Transformer Manufacturers' Association were condemned as "against the public interest" in a judgement of the Restrictive Practices Court, delivered last week. As a result, various arrangements for fixing minimum prices charged in the home market, and some discount arrangements will have to be abandoned. Agreements applying to the export market are not affected automatically by the judgement.

Basis of the agreements was that prices should be not less than a minimum figure, based on the lowest three cost estimates submitted by members for any particular design, plus a percentage profit, and less certain discounts and other deductions, taking account of competition from outside the Association, and known as "selling factors." The Court found that there was also an agreement for collective rebates on area board purchases from members; these had not been defended before the Court, and were also condemned as against the public interest.

Facts and Argument

It was established in evidence that the members of the Association produced all the large transformers made in this country, and most of the smaller transformers, although there were 50 to 60 other firms making transformers, mainly in low ratings. The members of the Association exported a third of their total production, and were responsible for three-quarters of the country's exports of transformers.

The case for the Association, which under the terms of the Restrictive Practices Act had to satisfy certain arbitrary tests if its agreements were to escape condemnation, was presented along three lines. According to the first, if the agreements were abandoned, a price war would result, and profits would be cut heavily. The consequence would be a reduction in spending on research and development. Moreover, manufacturers would cut quality in transformers and would cease collaboration on technical matters.

The second line of argument was that a price war in the home market would lead to a reduction in spending on securing export orders; while the export agreement would be abandoned, with resultant loss of collaboration in building up information on foreign markets.

Finally, as regards transformers for voltages above 33 kV, it was argued that the agreement was reasonably necessary to secure fair terms from the CEGB, which was the predominant buyer.

Judgement

The Court thought that although loss of the agreement might lead to reductions in prices, particularly of the larger transformers, it had not been demonstrated conclusively that there would be any less research or development, nor any substantial drop in quality. Nor did the Court think that if exchange of technical information stopped, it would have the effect of lowering quality.

It was possible that there might be some reduction in design margins, which had been provided in excess of specifications, but purchasers today were well qualified to scrutinise quality and specify for it, and it appeared to the Court that no manufacturer who proposed to stay in business would take a risk on his good name in the matter of quality.

Profit figures for all types of transformers taken together, the Court found, gave an overall weighted average for the years 1955 to 1959 of 11·4%. The highest average in an individual year was 16·9%.

In the opinion of the Court, the supply authorities were not actively working to depress prices. Although manufacturers argued that price cuts would be more severe because manufacturers would not know what prices were quoted by their competitors, in fact there was no reason why there should not be general notification of the varying prices tendered, after the tender had been accepted.

The export argument, which had been particularly forcibly pressed by the Association, was also rejected by the Court. It was felt unlikely that there would be any lessening of effort or reduction of spending in the drive to secure export orders. The exchange of information about export markets, provided for in the agreement, was not considered of great value. If the export agreement ended because loss of the home agreement, that would help exports. This, in the Court's opinion, followed from the dislike of some countries for level tendering, and the fact that at least one order had been lost to the UK as a result of level tendering.

Finally, the claim that the agreement was necessary to secure fair terms from the CEGB was rejected. In the context of the RTP Act, fair terms meant terms that would enable an efficient manufacturer to sell goods at no more than a reasonable profit. Evidence had shown that the weighted average of profits on sales of large transformers varied from 24·8%, as a percentage of turnover, in 1955, to 19·2% in 1959, the overall average being 22·1%. These figures had to be considered, in the opinion of the Court, against an absence of disposition on the part of the CEGB to force unreasonable terms. Again, the Court was not satisfied that abolition of the agreement would result in other than fair terms to manufacturers.

As a result of these findings, the Court ruled, as indicated, that the agreements were against the public interest. They will accordingly have to be abandoned.

Hearing of the case took 25 days, and was the longest yet to be conducted before the RTP Court. There are various somewhat similar agreements applying to the electrical industry now in course of preparation for trial, and the judgement in the present case is likely to have an effect on these.

Members of the Association are AEI, Crompton Parkinson, English Electric, Ferranti, Fuller Electric, GEC, Hackbridge and Hewittic, Johnson and Phillips, C. A. Parsons and Bruce Peebles.

Alternators for transport vehicles

DESIGN ASPECTS AND CONSIDERATIONS

ONE of the features of last year's Motor Show, dealt with at length in these pages,* was the introduction of the alternator/rectifier combination as a replacement for d.c. generators which have so long been an established part of road and rail vehicle equipment. At the CAV Western Areas Agents' Conference at Torquay last Thursday, Dr W. D. Sutherland, B.SC., PH.D., A.M.I.E.E., Chief Engineer of CAV Ltd., disclosed many of the design aspects and considerations in an interesting paper, "Application of Alternators for Transport Vehicles."

There is something of a fortuitous aspect about the development of semiconductor rectifiers at a time when the electrical demands in all classes of transport vehicle, road, rail and air, are beginning to exceed the limits of practical development in conventional d.c. generators for this class of duty. Metal rectifiers in combination with alternators could obviously have replaced the d.c. generator 20 or more years ago but there would have been little or no weight advantage, an adverse space penalty and an appreciable rise in cost. These factors were more than sufficient to stifle interest so long as established designs of generators could cope with electrical demands in conjunction with vehicle battery capacity during idling and stationary periods. Unless larger units were to be envisaged, there was clearly a demand for more effective use of the copper and iron in the existing machines.

Taking public service road vehicles as an example, the electrical load of a London bus in the 'twenties was of the order of 150 W; today's counterpart has an electrical system of about 1 kW, while congestion of roads in the major cities imposes a far larger part of running time when engine revolutions are below that necessary for normal battery charging. Analogous conditions occur on rail vehicles, particularly on diesel-engined railcars on relatively short routes with extended standing periods in intermediate and terminal stations. Often, engine idling periods are in excess of 60% of running time and the drain on batteries is excessive.

D.C. generator design has reached the optimum of performance within present-day frame sizes and speed range. It can only be increased by the adoption of larger units. This is not acceptable since it would increase installation and accommodation problems and, in addition, incur a weight penalty. One obvious solution is to adopt higher speeds, but this involves severe centrifugal stresses on the armature, already close to desirable limits, and increases bearing, drive and commutation problems.

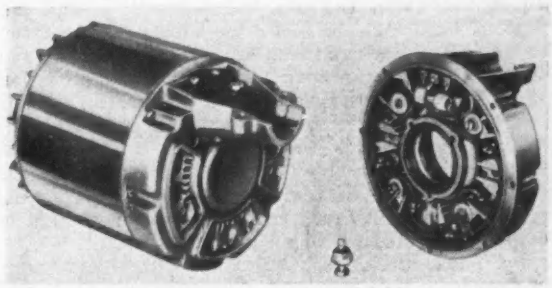


Fig. 2. View of a 7 in. a.c. generator, with built-in silicon diodes. The reverse side of the cover on the right shows the housing of the diodes

Advantages of A.C.

The adoption of a.c. generation means that the current-carrying windings can be transferred to the stator, thereby simplifying cooling and enabling an increase in copper to be employed, while the relatively simpler rotating field system, with its slip-rings, can be more robustly designed and is free from brush and segment problems inherent in the commutator. The current in the field is much lower, usually 1 A to 2 A, and the top speed will, therefore, be limited only by the purely mechanical aspects of bearing, drive and rotor design to counter centrifugal and out-of-balance forces.

In commercial vehicle practice the drive ratio is limited by the maximum permissible belt speed for commercially available belts and the sizes of pulleys used. It is normal to limit peripheral speeds to below 6,000 ft/min, which gives a maximum ratio of 3:1 for most commercial applications, though this should be modified where the engine is designed to give rapid acceleration and retardation, since sudden changes of speed impose additional forces on account of the inertia of the alternator rotor.

Alternators can be designed with a choice of windings in a given frame size to meet particular load requirements and speed ranges. High drive ratios enable greater outputs than from a d.c. generator of comparable size; alternatively, greater outputs at lower speeds could be achieved. The latter is most useful where long periods at idling, or near-idling, speed such as are experienced in heavy traffic are to be expected. Unlike the d.c. generator, an alternator is unaffected in performance by direction of rotation, an obvious advantage on rail vehicles which incorporate axle-driven generators and, in a normal day, cover an equal distance in either direction.

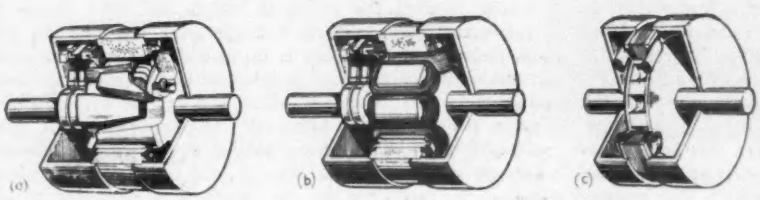


Fig. 1. Diagram showing constructional differences in a.c. rotors, (a) imbricated-pole, (b) salient-pole, (c) inductor

* ELECTRICAL TIMES, 3 November, 1960, page 676.

Windings and Rotors

The number of output turns in an alternator can be increased substantially without the risk of excessively high reactance, a cause of commutation difficulties in the d.c. machine; moreover, the flux can be made reasonably small. The size of alternator to obtain a desired cutting-in speed will, therefore, be smaller than that of the d.c. counterpart.

Another point is that windings of a d.c. armature are subjected to a combination of centrifugal and thermal stresses which limits the operational temperature, and also the load, to a point at which the soldered connections will remain stable. The same connections in a static a.c. winding, freed from the centrifugal stress component, can be considerably up-rated both as regards temperature and output. Cooling is simpler and little or no protection against ingress of dust is necessary as with the d.c. machine since these mostly affect the commutation and brush gear. A.C. slip-rings can be shielded in a small compartment. While a single-phase machine is the simplest form, the adoption of three-phase windings, by making better use of the available flux, will enable half as much again in output to be obtained within the frame size.

For public service vehicle alternators, three basic types of field rotor were considered; inductor, salient-pole and imbricated-pole (Fig. 1). The inductor type, in which both field and current windings are stationary and are linked sequentially by a rotating inductor, appears to be the most attractive. The flux path, however, limits the voltage produced from a given iron content to about half of that with wound field types; moreover, the flux does not reverse from positive maximum to negative maximum, but only from maximum to zero each half-cycle.

Choice between salient-pole and imbricated designs is not so obvious. The extreme robustness of the latter, in which the field winding is an annular coil on the rotor core enclosed between the poles of the two claw-type pole assemblies, swings the balance in its favour, and this is the design which has been adopted.

Rectification

Rectifiers are an integral part of the alternator system, but, being static components, they need no attention once they have been installed. Commutators and brush-gear on the d.c. machines are, of course, a main item of maintenance. For a three-phase machine, six (or multiples of six) rectifier units or cells are required to give full wave rectification.

Semiconductor rectifiers are universally used with alternators on vehicle systems. Three materials, selenium, germanium and silicon, are employed, the choice depending on ambient temperature, cooling facilities, space availabilities and initial cost. Selenium, used for many years, is the cheapest but has a relatively low peak inverse voltage (42 V), low current density, low maximum junction temperature (80°C), and is subject to ageing. Its bulkier design enables it to withstand overloads for short periods without incurring serious damage and its efficiency, at 95%, is the lowest of the three. Both germanium and silicon operate at higher current densities and both have higher peak inverse voltages and efficiencies up to 98%. Silicon can withstand junction temperatures up to 150°C, as against 65°C for germanium, and will probably completely replace it in this application in due course. Both types are destroyed immediately the rated operating conditions are exceeded.

The higher operating temperature enables silicon rectifiers to be incorporated in the alternator, where cooling can be obtained from the fan and, in this manner, the unit offers all the advantages of the d.c. machine plus greater output and freedom from commutating and brush problems. Fig. 2 shows a view of an alternator with, on the right, an inside view of one end plate, showing the silicon rectifiers in place with connections. The individual rectifier unit can be seen in front.

Reliability of semiconductor cells is mainly dependent on methods of production—in which impeccable cleanliness is a vital factor—moisture-tightness through imperfect encapsulation and subsequent cooling through the provision of an adequate "heat-sink" and/or other form of dissipation. With manufacturing techniques improving day by day, the percentage failure risk is already so small as to be negligible. Faults which do not appear within the testing period are not likely to arise during the working life of the rectifier, which, according to some manufacturers, is likely to exceed a million hours.

Applications

Considerable experience with a.c. public vehicle units has already been achieved. On railcars the introduction of the alternator with germanium rectifiers has resulted in batteries being kept fully charged, despite the vicissitudes of suburban and branch-line operation. Alternators with outputs from 50 A in an 8 in. frame to 150 A in a 14 in. frame are included in this sphere. In the motor vehicle field the most successful applications have been on fire engines, taxicabs, police cars and ambulances with mobile radio, which make considerable demands on the battery and spend large parts of their time "standing-by" or cruising at low speeds.

For buses, the present d.c. generator is of 7 in. diameter with an output of 55 A at 24 V and is driven at ratios of up to 2·3:1. At idling speeds the generator output is negligible. With a 7 in. alternator the output at the same idling speed is sufficient to provide a major part of the electrical load. It weighs 37½ lb, as compared with 84 lb for the d.c. generator; moreover, on account of the better state of charge possible, it is even reasonable to suggest that the battery size and weight could be reduced. If we take into consideration the rectifier, the additional weight using selenium as a separate unit is 20 lb, which still saves 26½ lb, but built-in silicon diodes only increase the weight by ½ lb.

The alternator is designed for a 24 V system and the output is self-limited to 60 A at 27½ V. "Cutting-in" takes place at 580 r.p.m., corresponding to engine idling speeds of 350 r.p.m. to 400 r.p.m. where the d.c. output is of the order of 19 A to 30 A. Ventilation is by built-in fan, which drives the air through the machine interior around the slip-ring enclosure.

Control Board

Two control units, or voltage regulators, can be used; the first is the conventional vibrating contact and the second a transistorised version. In the latter, a zener diode reference source is used in conjunction with a transistor switching device to cut in or out a resistance in the field circuit. If the voltage rises to a point at which the zener diode collapses, the through current triggers the main transistor to put the resistance in circuit. The fall in voltage reaches the point at which the zener diode is "reinstated" and, in turn, it triggers the transistor to cut the resistance out. There is no sparking at contacts and, consequentially, no wear or interference. A reverse current cut-out is not necessary since the rectifiers themselves serve the purpose. Although the application of a.c. systems to public service vehicles is still in its infancy, enough experience has been gained to make it certain that it is the system for the future, with extension to all other spheres of transport in due course.

Luton Airport Lighting

INSTALLATION INCLUDES LATEST APPROACH AID

WITH today's increasing air traffic density, coupled with higher aircraft speeds, adequate airport lighting is essential in ensuring safe landings and take-offs at night and during periods of poor visibility. Conforming to the latest standards is the recently completed lighting installation at Luton municipal airport for which all fittings were supplied by the General Electric Co. In addition to the usual approach, threshold and runway lights, the installation also boasts visual glide-path indicators.

Visual Approach System

The VGPI system, as installed at Luton, was developed by the RAE, Farnborough, and is being adopted internationally. It gives a simple and effective means of enabling a pilot approaching the runway to ensure that his glide path is correct, relative to the touch-down zone. This is achieved by two rows of two-colour beam lights transverse to the runway which define the limits of the touch-down zone.

Each row has six lights, three on opposite sides of the runway. The top half of the beam emitted by these lights is white, the bottom being red. The indicator lights are so angled that if the glide-path of an approaching aircraft is too steep, causing an undershoot, the first and second rows of the indicators will appear to the pilot to be both red; if his path is too shallow both rows appear white. If, on the other hand, the first row appears white and the second red, then the pilot knows that his glide path is correct, usually about 3°. The GEC fittings for this purpose have four 200 W lamps with reflectors and glass colour filters housed in a bonded fibre-glass casing. The units, which are fitted with isolating transformers, are mounted on screwed stems to enable levelling and adjustment of beam elevation.

Runway Lighting

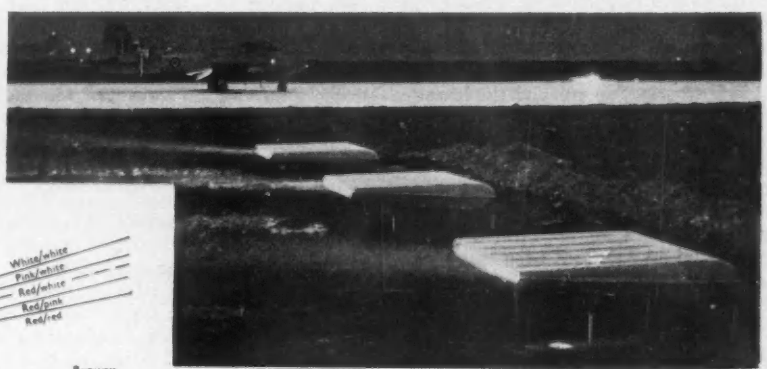
The main body of the airport installation comprises the threshold and runway lighting. The runway lights are 200 W elevated units, mounted at 200 ft intervals along the edge of the main runway. They have bi-directional high-intensity beams directed up and down the runway at an elevation of 3° to suit the glide path. In addition, they give a low-intensity, omni-directional light output which helps pilots to locate the runway when circling. Feature of the mounting of these lights is the incorporation of a weak link so that they break off easily if accidentally struck by an aircraft's undercarriage. Where the main runway intersects the grass runway, semi-flush fittings have been used. Threshold lighting consists of a row of 18 high-intensity fittings having green filters. Eight of these are of the semi-flush type let into the runway.

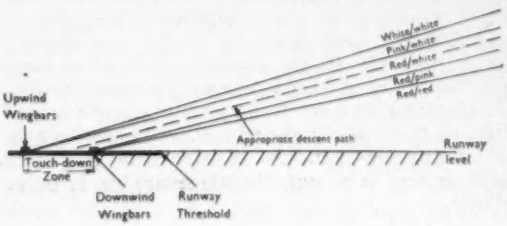
Approach lighting, mounted on poles of up to 60 ft high is of two types; low-intensity, omni-directional red lights laid out on a 1,400 ft centre line, and high-intensity uni-directional lights from the runway threshold. Bisecting the centre line at 1,000 ft from the threshold is a "crossbar" of alternately high- and low-intensity lights.

Series Circuits

A feature distinguishing modern airfield lighting from more general installation practice, is the use of series ring-circuits to connect the lights. At Luton 34,000 yd of 3 kV, butyl rubber, p.c.p. sheathed single-core cable was used for this purpose. Each light on a series circuit is connected through an isolating transformer so that failure of any lamp will not interrupt the circuit. In the case of the runway and threshold lighting, two series circuits are "interleaved," ensuring that, should one circuit fail, alternate lights will remain on. Series circuits are fed through voltage matching transformers from the main 415/240 V three-phase four-wire distribution system and controlled individually by contactor cubicles. The l.v. distribution itself is controlled from a switchboard, fed through a step-down transformer, from the incoming 6 kV supply.

Lighting circuits as a whole are controlled from a single console in the airport control tower which incorporates a mimic diagram of the installation. An important feature is brightness control by means of which the intensity of approach, threshold and runway lighting can be adjusted to suit a wide range of visibilities.





GEC high-intensity visual glide-path indicators

Illustrating the VGPI system giving red-white indication of glide path

Wholesaling prospect

EUROPEAN VIEWS AT E.W.F. ANNUAL DINNER

THE state of wholesaling in Britain and in Europe generally occupied the principal speakers at last week's annual dinner of the Electrical Wholesalers' Federation. The retiring EWF president, Mr G. Conradi, sketched the highlights of the British scene; the Continental viewpoint came from Mr R. F. van Heusden, currently vice-president of the European Union of Electrical Wholesalers, as well as president of the Dutch Federation.

Mr Conradi spoke first of the attention the EWF have given to the techniques of selective distribution and of operating voluntary groups and voluntary chains; studies not yet complete. The latest approach is to improve efficiency through inter-firm comparison, which is just starting. Initially, nearly half the members of the Federation will provide basic information from their final accounts, which will enable them to measure overall efficiency yearly and to check whether it is lower than the average for other wholesalers in the same turnover bracket.

Resale Price Maintenance

RPM usually finds a mention when wholesalers talk, and Mr Conradi gave a new twist to the topic with a description of the results of the relatively recent outlawing of resale price maintenance by the French Government. "The resulting chaos," he said, "has been complete and has brought no direct benefit to anyone." The new French code makes it illegal to impose minimum selling prices by any means; to refuse to sell or sell selectively; to offer different prices or discounts to different buyers; to have any sort of understanding between manufacturers; and to incorporate contractural clauses such as "selling in accordance with our standard conditions of sale." There is provision for exemptions, but very few have been granted. "Functional discount has been abolished and the ground cut from under the wholesaler's feet."

What had happened in France could well happen in Britain. It ought not to be imagined that if the law were altered here it would be only establishment of minimum prices that would be forbidden. The EWF believed in RPM. It was the way of life through which a thriving industry had been built up, with safety standards second to none and a large and profitable export business based on an expanding home market. Critics of RPM had played down one of the gravest dangers inherent in its abolition. This was the way monopolies would grow in a completely free market—which meant a cut-price market. Once a monopoly had been established, then the business concerned could raise prices to a level which would recoup its earlier losses.

Making specific mention of an American-style discount house in Leeds, Mr Conradi urged manufacturers to use their rights within the law to stop the activities of such an organisation and so protect their wholesale and retail distribution.

Continental Trading

The Continental picture as painted by Mr van Heusden was quite as threatening as that in this country. Throughout Europe there was a trend towards Government interference in the freedom of firms to co-operate. It was the opinion of those in the trade that in today's complicated society co-operation was necessary. The climate of relationship between Government and industry was not so good as it should be.

Where wholesaling firms intended to open a branch in overseas countries, the European Union asked them to recognise fair trading rules in those countries. It had to be realised that it was not the number of wholesalers in an association that was vital, but rather the quality of the firms and the way they fulfilled their task. There had to be caution about bringing in too many firms who partly fulfilled the wholesaling function.

In the highly competitive situation brought about by development of new electrical appliances, appliances were supplied through dealers outside the electrical wholesaling trade. The European Union thought it important that wholesalers and contractors and retailers should seek a situation in which their mutual interests could be discussed. Manufacturers needed to realise that the wholesaler took away many of their worries through his close knowledge of the retailers' circumstances.

The tendency apparent in other trades to eliminate the wholesaler seemed unlikely to appear where technical articles were being dealt with. This was because the judgment of the wholesaler on quality was important. The very variety of electrical appliances available made it impossible for the retailer to keep a full stock. The wholesaler, through his showroom, strengthened the retailer's ability to compete with multiple stores.

Mr van Heusden thought that in the wholesaling trade there was too little attention to such matters as efficiency and credit arrangements. The wholesaler who, by improved performance, achieved a larger turnover ought to be able to record a larger profit. However, in the present situation, it was the wholesaler who neglected his task who often got the better return.

Lamp Sales

After the toast to the Federation's guests had been proposed succinctly by the vice-president (now the president, see page 521), Mr J. H. Hirst, Mr W. J. Jones, director of ELIC, replied. He said the electrical industry had much to learn from its opposite numbers on the Continent; and they could learn a lot from British practice. On the subject of lamps, he said that the annual sales had risen from an average of one lamp per head of population in 1924 to 4½ lamps per head at present. The wholesaler had benefited accordingly.

AROUND THE TRADE

BY PEREGRIN

MARCH has been a month of exhibitions, and visiting the Ideal Home Exhibition at Olympia one felt a certain amount of frustration that the proposed electrical appliances exhibition fell through last year; for it seemed that the electrical section attracted the greatest possible interest—a worthwhile display of electrical domestic appliances tastefully and attractively set out. What a pity some of these firms cannot get together to give a start to their fellow manufacturers in staging a great exhibition of their own.

Appliance Introductions

Cookers seemed to create much interest, but it was to the more conventional designs that people turned. The Canadian influence is obvious in the more elaborate models —which are somehow reminiscent of sterilising units! But while it would be a pleasure to use one of these, providing the bank overdraft permitted its purchase, most people seemed afraid of them, as being too complicated to understand. The rota-spit idea had been adopted in many of the conventional models, usually as an eye-level unit, but Creda have enclosed theirs in the oven. This might not be so convenient if there is other oven-cooking to be done at the same time, but the spit roasting idea is sound. More thought has been given this year to the question of spillage, and I would certainly give GEC full marks for their hinged boiling plates, spillage holes and enamel drip trays—all making for easy cleaning. Incidentally, GEC had a very attractive fixture showing their range of smaller appliances; quite a model for retailers in their showrooms.

One stand which was literally buzzing with interest was showing the new Electrolux drum-shaped dishwasher. The washing action was visible in the special display models and the demonstrators were kept hard at work answering questions. If this interest is sustained, good sales should result, and it could easily be a challenge to the Colston model. So much depends on the Electrolux plan of campaign. Colston's sales plan was well thought out and ready for immediate action before the dishwasher was put on the market. Not so, perhaps, Swan, which has never seemed to me to get going. Even a good article has to be sold to the public, and particularly when so many manufacturers are covering the same ground.

One thing that did surprise me with Electrolux was the introduction of another silly little refrigerator. Jackson produced one last year which my staff could not sell—perhaps a matter of sales training—but these little refrigerators seem a confession of failure rather than an effort to give the public something it can afford. Another trouble is that they need something to stand on, otherwise the poor housewife has to adopt a jack-knife position to load them. The stand, of course, is an extra.

It looks as though the market for automatic washers is, contrary to expectations, rapidly expanding and fast overtaking the combined washer and spin-dryer; Hoover, Hotpoint and English Electric were all attracting a great deal of interest. Creda had their new washer and spin-dryer sitting side by side—quite unimpressive; and yet I would give them full marks for their excellent kitchen set-up—although why they should want two similar 'fridges hung side by side in the kitchen I know not. I thought the days had gone when a trader could sell two of anything to one customer: it has been a buyers' market now for some time.

I noticed Hotpoint had gone one better than Tricity in refrigerator design. Tricity make the attractive "diner-cold" for use in the dining-room, but Hotpoint were showing a diamond-studded model, presumably for use in the drawing-room. I like the Hotpoint range of colours, too, although I do feel that too much choice means a headache for both manufacturer and dealer. Kelvinator were showing a new upright deep-freeze and two combined refrigerator and deep-freeze models. Interesting, but the prices seemed much too high to put them within the range of the normal domestic pocket. Nevertheless, they appeared well designed and constructed.

I was surprised to hear demonstrators advising an inquirer to leave a refrigerator on defrost overnight and normal by day to keep it clear of frost, and further assuring her that this would have no adverse effect on frozen food. This is quite contrary to the frozen food suppliers' common sense instructions. To me, all this fuss over the process of defrosting seems pointless. A housewife must clean her refrigerator cabinet in addition to defrosting it, and what simpler than to switch off completely and do the two jobs in one. Far better than coping with the drippy state of automatic defrosting.

There were many more attractive exhibits, and both the Belling and Berry fire displays were creating interest. I must say, however, that in the higher priced range of coal and log fires I found Berry's designs more pleasing. Also, Berry's new log grate with the retractable element and removable log unit could be quite something for the modern home.

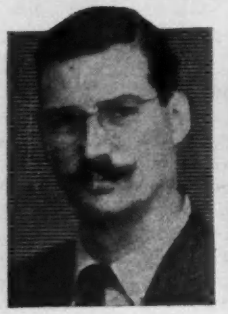
Working Week

And, while all these tempting appliances are being offered to the public, the question of how many days a week the retailer may offer them for sale is much in the news. Articles have been written about it and there has been much talk by people who seem to know nothing of the retailer's problems and even less of the housewife's. And I wonder if all actively concerned with retail business are giving sufficient thought to this question of a five-day week? It is bound to come, for there is no reason why shop assistants should be treated differently from any other section of the public, but every trade is different. While it may be competent for a firm like Sainsbury's to close all day Monday, it would not suit every trade. Further, the assistants' point of view must be considered and they may demand Saturday to be with their friends. Yet Saturday is the day that the housewife, complete with new pay packet, takes the family for her specialist shopping—including the new 'fridge and TV.

It seems to me that some sort of a shift system will have to be evolved so that the electrical retailer can continue to give the service that is due to the public. In any case, it is time we put away our ostrich attitude and faced the facts and commenced frank, sensible discussion and negotiation to settle what, at least, is best for our section of the trade.

Personalities *in the industry*

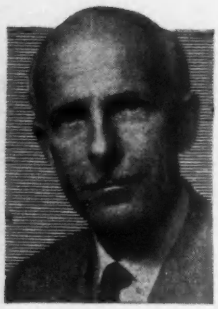
Mr V. J. Ross



Mr G. G. Thornhill

Mr E. C. Rippon

Mr T. G. Christie



Mr C. M. Stoupe

Formerly sales manager for Scotland to Scottish Cables Ltd. (a BICC subsidiary), **Mr V. J. Ross,** A.H.W.C., A.M.I.E.E., has now been appointed assistant regional manager, Scotland, to British Insulated Callender's Cables Ltd. Educated at Grantown Grammar School and Heriot-Watt College, Edinburgh, Mr Ross joined Scottish Cables Ltd. after war service in the Electrical and Torpedo branch of the Royal Navy. He will be located at the BICC Scottish Regional office in Glasgow.

At present resident site engineer of the CEGB's Willington "B" power station under construction near Derby, **Mr G. G. Thornhill,** A.M.I.E.E., M.I.PLANT.E., has been appointed to a similar position at the Sizewell nuclear power station on the Suffolk coast, where site work is to begin on 4 April (*ESH, page 52). Mr Thornhill has been closely associated with the post-war development of power stations in the Trent Valley. He has held posts at Spondon and Castle Donington before going to Willington "B" last year, and prior to nationalisation of the Industry served with Loughborough Corporation undertaking for many years.

Mr Alfred Neate has been appointed a director of Harper Engineering and Electronics Ltd.

Mr F. H. Puxty and **Mr. F. E. Winstanley** have been appointed directors of Greengate and Irwell Rubber Co. Ltd.

Mr Alan S. Brewer is resigning on 31 March from his position as advertising manager, Cables and Construction Divisions, and deputy group advertising manager of Associated Electrical Industries (Woolwich) Ltd. This position ceases to exist as a result of the formation of a single publicity department serving all AEI Divisions. Mr Brewer joined Henley's in 1922 and has been associated with their advertising since 1925. He was appointed assistant advertising manager in 1954 and advertising manager of both W. T. Henley's Telegraph Works Co. Ltd. and Henley's Tyre and Rubber Co. Ltd. in 1955. He also edited the *Henley Telegraph* and *Distribution of Electricity*.

Mr E. C. Rippon, M.I.E.E., has been co-opted a director of C. A. Parsons and Co. Ltd. Mr Rippon, who was formerly chief transformer engineer, has during the last year been engaged in matters relating to the organisation of design and production throughout the works. He has for a number of years represented British interests on International Technical Committees in the field of transformer engineering and has contributed to standardisation work both at home and abroad. He will continue this interest in such technical matters. Mr Rippon has served with C. A. Parsons throughout his career, gaining early training there. He became chief transformer engineer in 1947 after six years as assistant transformer manager. He was chairman of the IEE North Eastern Centre in 1951-52.

Mr James Hamilton, a past president of the Birmingham Electric Club, was elected honorary life vice-president at the annual meeting of the club in Birmingham last week. He has been a member of the club since 1925. **Mr A. R. Leith** was elected president, **Dr E. H. Norgrove** senior vice-president, and **Mr R. A. Joseph** junior vice-president, with **Mr F. G. Furniss** re-elected as hon. secretary.

Mr G. D. Kaye, M.A., B.COM., A.C.I.S., has been appointed assistant secretary to Newman Industries Ltd. Educated at Royal High School, Edinburgh and Edinburgh University, Mr Kaye was afterwards appointed assistant secretary to the Edinburgh Chamber of Commerce. Prior to his new appointment he was economist at the South West Regional office of the Board of Trade, Bristol.

Mr C. W. Allen has been appointed secretary of the Association of Electrical Machinery Trades in succession to the late Mr J. T. Morgan.

Formerly deputy chief engineer, **Mr C. M. Stoupe,** B.SC., M.I.E.E., has been appointed general manager and chief engineer of the Electricity Board for Northern Ireland, as from 1 April, following the retirement of **Mr T. G. Christie,** O.B.E., B.SC., A.R.C.SC.(I)., M.I.MECH.E., M.I.E.E., from that position. Mr Christie will, for a limited period, be engaged on special duties for the Board. **Mr J. J. Patterson,** A.C.A., chief accountant and financial controller will, as heretofore, be responsible for the financial arrangements and all accounting matters in connection with the Board's undertaking. (*ESH, page 180.) Mr Stoupe, who has been deputy chief engineer since 1958, has been with the Board for the past 27 years, and earlier was with Metropolitan-Vickers in the Meter Instrument and Relay Department. He joined the Board at the time it was most actively engaged in acquiring numerous small undertakings and changing over supplies to the grid system. In 1936, as assistant technical engineer, he took over the additional responsibility for the installation and maintenance of switchgear and protective gear in the rapidly expanding 6·6, 11 and 33 kV systems. He was promoted to technical assistant in 1944, and to chief technical assistant in 1948, then acting as deputy to the chief engineer on power supply matters. Mr Stoupe was chairman of the IEE Northern Ireland Centre in 1957-58. Mr Christie has been the Board's chief

** Denotes revision to the "Electricity Supply Handbook, 1961."*

official since the retirement of Mr A. W. Ferguson at the end of August, 1958. Prior to that he had been chief engineer of the Board since 1936. A native of County Antrim, Mr Christie became lecturer in electrical engineering at Belfast College of Technology in 1918, and joined Metropolitan-Vickers in 1920. He returned to Ulster in 1923 as assistant technical engineer in the Belfast Corporation Electricity Department, and in 1932 was promoted to chief technical assistant, stepping up to chief engineer four years later.

Mr E. J. Goldsmith, a linesman with the Eastern Electricity Board, is to be the next Mayor of Southwold, on whose Council he has served for the past 11 years.

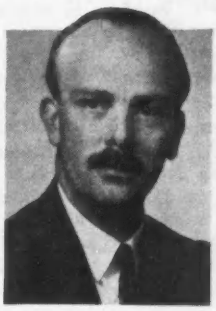
Mr F. R. Allen, an executive director of Firth Cleveland Instruments Ltd., is now in charge of the company's sales engineering department.

Mr J. H. Munns, to whom we referred on 16 March, has just joined Aircraft-Marine Products (Gt. Britain) Ltd. as area sales engineer for South West England. For the past seven years he has been sales representative in the West Country for Ekco-Ensign Electric Ltd.

Secretary of No. 3 sub-area of the Merseyside and North Wales Electricity Board since 1948, **Mr R. D. Thomas,** D.P.A., F.C.I.S., has been appointed establishment officer to the Board (*ESH, page 135). Prior to nationalisation of the industry he was clerk and accountant to the West Cheshire Water Board.

The new chief engineer of the London Electricity Board is to be **Mr A. G. Milne,** M.I.E.E., M.I.MECH.E., at present manager of the Bristol District of the South Western Electricity Board. He succeeds **Mr L. H. Welch,** O.B.E., B.SC.(ENG.), M.I.E.E., who is retiring next month as we earlier reported. (*ESH, pages 77 and 100). Prior to his appointment as Bristol district manager last April, Mr Milne had been deputy chief engineer of the South Western Board since 1951, following three years as manager of that Board's Bath district.

Mr. A. G. Milne



Mr. J. H. Hirst

Mr. F. Widnall

Mr Milne's technical education and apprenticeship were at Faraday House, where he was awarded an Honours Diploma, and with C. A. Parsons and Co. Ltd. In 1934 he joined the County of London Electric Supply Co. Ltd. and subsequently held appointments with the Yorkshire Electric Power Co., Thomas Firth and John Brown Ltd. in Sheffield, and the Blackburn Corporation electricity undertaking. In 1947 he was appointed deputy city electrical engineer at Bath.

Mr John H. Hirst, managing director of Hirst, Ibbetson and Taylor Ltd., has been elected president of the Electrical Wholesalers' Federation for the ensuing year. Mr Hirst has been on the Council for three years as Councillor for the North Western Section. He is chairman of the Federation's Appliances Committee and a member of its Advisory Committee, Lighting Fittings Committee, Cable Committee and Installation Materials Committee. He also represents the Federation on the British Electrical Approvals Board for Domestic Appliances. **Mr H. D. Denman,** of Denman Electrical Supplies Ltd., has been elected vice-president of the Federation; **Mr E. H. Maltby,** of Edmundsons Electrical Wholesalers Ltd., has been elected councillor for the London and Home Counties Section, and **Mr H. Riley,** of John Riley and Son (Electrical) Ltd., re-elected councillor for the Yorkshire and Mid East Section.

Mr F. Widnall, B.SC.(ENG.) M.I.E.E., manager and engineer of the Hereford Lighting Equipment Works of AEI Lamp and Lighting Co. Ltd. for the past five years, has been appointed manager of the company's Lighting Engineering Department, with his office at Melton Rd, Leicester. He is succeeded as manager of Hereford works by **Mr T. W. Grieve,** B.SC.(PHYS.) SPEC. Mr Widnall joined BTH as an apprentice (student) in 1924 and worked in the Rugby Research Laboratory, the Domestic Appliance Engineers Department and the Lighting Equipment Department until he was appointed manager of the latter in 1948. He continues to be responsible for the lighting equipment engineering group at Hereford. A newcomer to AEI, Mr Grieve was previously the technical and works manager for Williams and Williams Ltd., Cheshire. Prior to that he worked for 10 years for the British Coal Utilisation Research Association, carrying out Government research during the war and working on industrial and domestic heating and utilisation problems afterwards. From 1952 to 1956 he was works manager for Ludlow Bros. Ltd., Birmingham, and later technical adviser to industry for the Gas Council.

The BBC announce that **Mr C. H. Colborn,** B.SC., M.I.E.E., who is retiring after 37 years' service, will be succeeded as head of the Television Studio Section, Planning and Installation Department, by **Mr D. R. Morse,** A.M.I.E.E. In addition, **Mr R. J. Keir,** O.E.E., B.SC., A.M.I.E.E., resident engineer for the BBC Far Eastern Station, Singapore, will complete his term of duty in April, and will be succeeded by **Mr D. N. H. Lambert,** B.SC.(ENG.), A.M.I.E.E. **Mr V. A. E. Hember** has been appointed engineer-in-charge of the transmitting station at Clevedon, Somerset, in succession to Mr Lambert.

Mr C. G. Marsh, of Meggitt, Marsh and Co., has been elected chairman of the Bournemouth branch of the Electrical

During a visit to the ERA stand at last week's Electrical Engineers Exhibition, Mr A. N. Irens (chairman, S. Western EB) and Sir Christopher Hinton (chairman, CEGB) are seen with Mr E. E. Hutchings (left) and Mr F. G. Stevens, manager, Rectifier Division, Hackbridge and Hewittic Electric Co.

Contractors' Association. **Mr R. L. Wilkinson,** of Electrical Services (Dorset) Ltd., is the new vice-chairman, and **Mr A. H. C. Wright,** hon. secretary and treasurer.

Mrs Rosalind Messenger, M.B.E., adviser on women's work to the Eastern Electricity Board since vesting day, has retired from the service of the Board. She was recently the guest at a luncheon given by the chief commercial officer and members of the Board's commercial staff. Mrs Messenger came into the industry when she went to Bungay, Suffolk, as Miss Rosalind Haslett in the 'twenties to take charge of the showroom owned by the Bungay Electric Light and Gas Co., of which Mr Ernest Messenger was the engineer and manager. Her sister, Miss Caroline Haslett, later Dame Caroline, was a founder director of the company and Miss Rosalind Haslett remained in the town to become the secretary and accountant of the company and, in 1930, Mrs Ernest Messenger. The company was unusual in that it afforded opportunity to women to enter the industry and at least three who were introduced by Dame Caroline Haslett achieved a degree of fame in later life. Mrs Messenger herself gained a wide experience from working at Bungay and she was, in turn, meter reader and collector, secretary, accountant, buyer and, on occasion, the deputy engineer in charge. In addition to her work for the Board, Mrs Messenger took a great interest in local affairs and was the first woman to become Town Reeve of Bungay. In recognition for her public work Mrs Messenger was appointed a Member of the Order of the British Empire.

Mr A. F. Thomas, F.C.A., and **Mr D. J. W. Dolton,** F.C.C.S., have been appointed to the boards of Sperryn and Co. Ltd. and C. H. Edwards Ltd. (both members of the Delta Group). Mr Thomas is assistant managing director of the Delta Metal Co. Ltd. and Mr Dolton is personal assistant to the directors and assistant secretary.

Lord Cohen of Birkenhead has been elected president of the National Society for Clean Air.

OBITUARY

Sir Patrick Cooper, who was a director of the General Electric Co. Ltd., Sofina, and other concerns for many years, died on 22 March, aged 73. He was a member of the London Passenger Transport Board from 1933 to 1947 and served on various governmental committees.

Dr E. De Barry Barnett, D.SC., formerly deputy principal of Sir John Cass College, Aldgate, died on 23 March.

Mr W. H. Apthorpe, deputy chairman and former managing director of the Cambridge Instrument Co. Ltd., died on 17 March, aged 75. He started with the company in 1900, but resigned in 1907 to work in association with Messrs Clarke-Fisher and R. W. Paul. Three years later he was appointed assistant to Prof Donnon at Liverpool University. In 1914 he returned to the Cambridge Co. to take charge of the Testing Department, and when Mr Paul's business was absorbed in 1919, Mr Apthorpe was appointed works manager at the London factory. In 1925 he was appointed a director and was subsequently director of production, joint managing director, managing director and deputy chairman.

Mr R. Squire, A.M.I.E.E., works director of Crypton Equipment Co., died on 19 March, aged 62. He started his career as an apprentice in the Locomotive Dept. of the old L and SW Railways in 1916, and three years later joined Bruce Peebles and Co. There followed periods in Trinidad and with a switchboard firm in London and, in 1926, he joined Newtons of Taunton as a switchgear and rectifier designer. He remained with Newtons until 1934. After spending a year with Rotax Ltd. he joined Crypton Equipment, on the formation of the company, as chief engineer. In 1940 he was made works manager and, six years later, was appointed to the board. He was a member of the Western Committee of the British Productivity Council.

NEW LITERATURE

Hydro-electric Power

by E. F. Carter

ONE of a series on technical and scientific subjects aimed at the younger reader, this book surveys the development of hydro-electric power and the way in which it has been harnessed in various parts of the world. Writing in popular style the author explains the principles involved in water-power conversion against an historical background, describing improvements which have taken place since the early water-wheel up to present-day propeller turbines. The greater part of the book is devoted to general description of more spectacular aspects of civil engineering and constructional problems associated with the world's major hydro projects. These include some of the more recently completed schemes like Kemano and Kariba. The text is well illustrated with 20 photographs and there are a number of simple diagrams and sketches. Published by Frederick Muller Ltd., 143 pages, 5 in. by 7¼ in. Price 9s 6d.

Introduction to the Cathode Ray Oscilloscope

by Harley Carter, A.M.I.E.E.

THIS popular little work from the Philips Technical Library first appeared in 1957. The second edition differs only in that a number of typographical errors have been corrected and the last chapter, detailing three complete oscilloscope circuits, has been rewritten and modified to incorporate new features and to employ the later types of c.r.t. It is a very readable primer of cathode-ray oscilloscope principles, both as regards design and usage, which is invaluable to the student and teacher of electronics. The radio service engineer of limited means will also find the second circuit useful in helping him to make his own instrument. Published by Philips Technical Library, 121 pages, 8 in. by 5¼ in., with 99 circuit diagrams. Price 15s (second edition).

Radioactive Wastes

ed. by J. C. Collins, B.SC., A.M.I.C.E.

WITHOUT techniques for safely disposing of radioactive residues from its processes, the nuclear energy industry could not have developed. Those techniques have to strike a balance between, on the one hand, the pre-eminent demands of safety for present and future generations and, on the other, the desirability of not saddling a new industry with crippling costs. In the present volume the experience of a number of specialists is collected together for a non-specialist readership. Early chapters are devoted to a broad statement of the problem, including a particularly useful review of the hazards of radiation. Later chapters are concerned directly with the know-how of treatment and disposal of gaseous liquid and solid radioactive wastes. The varied contributions have been successfully blended to yield a most useful working reference. Published by E. and F. N. Spon Ltd., 239 pages, 8¼ in. by 5¼ in. Price 55s.

BOOKS RECEIVED

Complex Variables and the Laplace Transform for Engineers, by W. R. LePage. Mathematical text-book for graduate engineers with emphasis on interpretation of mathematical concepts for engineering application. Published by McGraw-Hill Publishing Co. Ltd., 475 pages, 9 in. by 5¼ in. Price 97s.

British Locomotives. Review of products present and past of the British locomotive industry, including extensively illustrated historical section. Published by The Locomotive and Allied Manufacturers' Association of Great Britain, 88 pages, 10¼ in. by 8¼ in. Price 15s. Copies can be obtained from Locomotive Hse, Buckingham Gate, S.W.1.

The Engineer Buyers' Guide, 1961. Classified list of 1,860 manufacturers and firms based on advertisers in *The Engineer* or in the present volume. The guide also contains a list of exhibitions in 1961 on an international scale, and addresses and brief details of associations, institutions and societies of importance to engineering industry. Published by Morgan Bros., 984 pages, 8¼ in. by 5¼ in. Price 12s.

Year Book of Heating and Ventilating Society, 1960-61. Technical, contractual and trade information for architects, consulting engineers, etc., who are in close contact with heating and ventilating contractors. Published by Technitrade, 506 pages, 8¼ in. by 5¼ in. Fourteenth edition. Price 15s.

Electrical Year Book, 1961, and Mechanical World Year Book, 1961. Compact handbooks of technical information. Published by Emmott and Co. Ltd., 363 and 238 pages, 6 in. by 3¼ in. Price 4s and 5s.

Electricity in heavy industry

ECONOMIC FACTORS IN CHOICE OF SUPPLY AND PLANT

THE great inherent versatility of electricity as a source of energy combined with its cleanliness, ease of control and simplicity of transmission has made it the inevitable choice in every branch of industry. From the smallest to the largest project, regardless of the end product, one of the first considerations is the availability of an adequate electrical supply at an economic tariff for lighting, heating, ventilation, motive power and communication.

Each project and each industry has its own problems which are capable of solution in a variety of ways and engineers everywhere are eager to discuss the manner in which their own particular installation was conceived, planned and installed. The free exchange of such experience and the discussion which arises from the various papers presented from time to time is one of the major reasons why techniques within the industry make such phenomenal progress.

It is in the really heavy industries, however, that the most extensive problems arise, problems which concern not only the motors, control gear and ancillary equipment, but such primary factors as the terminal voltage of equipment, type of switchgear, protection and distribution layouts which are normally taken care of by the supply authority in the smaller factories. Moreover, there is always the question as to whether, with really large demands, it is not likely to be more economic to install one's own generating plant.

All of these factors were the subject of an interesting paper* read before the ASEE in London last week by Sir Henry Clay, BT., M.A., M.I.E.E., in which he dealt mainly with the aspects in so far as they related to iron and steel industries.

Capital Equipment

In a large project the capital cost of electrical equipment may represent one-fifth of the total. In a representative case, the value of electrical plant alone amounted to £5¼ million, of which 60% was accounted for by motors, control gear and process plant, 18% for the associated cables and wiring, 12% for main switchgear and distribution cables, 7½% for lighting, small power plant and telephones and 2½% for temporary electrical supplies. On such a scale, considerable economies are possible by careful choice of each item remembering that, of itself, it is only a means to an end. It must be capable of paying its way.

In some projects, part of the capital estimates may be for works generating plant. Unless there is an associated demand for process steam on an economic scale, or waste heat is available in large quantities, it is cheaper today to use the public supply, no matter what may have been the case a few years ago. The reason is that larger generating sets with better efficiency are being installed in the major power stations—larger than could economically be justified in a works plant. The discrepancy between public and private generation costs might have been even greater had it not been for the legacy of smaller sets which the CEGB inherited from the post-war period.

Another aspect is the choice of tariff. Where electricity is only a small proportion of the manufacturing costs—and the average for all industry is around 2%—a standardised tariff is acceptable. Where it is used on a large scale and may account for as much as 50% of the manufacturing cost, a preferential tariff should be obtained by negotiation with the local area board. Not all boards, however, are willing to offer such tariffs and high load factor consumers may find themselves penalised thereby.

Incoming Supply

Most industrial premises will have an 11 kV service if their load is at all reasonable with a step-down transformer in the board's substation on the premises. If the load is, or is likely to exceed, 10 MW or more there is much to be said for a 33 kV service while, for loads in excess of 30 MW, a direct tapping from the 132 kV grid or, above 60 MW, the super-grid is the most economic arrangement, but Generating Board-Area Board policy makes this difficult to arrange.

Some loads have violent and rapid load fluctuations and must be fed from a point of sufficient "system stiffness." An example is the arc-furnace installation comprising six 40 MVA furnaces, now being constructed by United Steels, which will be supplied from the super-grid. It will be the largest arc-furnace steel melting shop in the world.

Works Voltages

Most motors of small and medium horsepower will derive their supply from the 440 V 3-phase mains but the larger motors are more efficient on higher voltages and require less copper in the cable conductors. For motors between 100 h.p. and 2,000 h.p. a 3·3 kV system allows of "direct-on-line" starting. For higher h.p. synchronous motors, 11 kV is more suitable, sometimes with unit transformers.

In regard to protective equipment, since most faults originate as phase/earth faults, some economies may be made by omitting phase/phase protection and confining the equipment to overload and earth fault sensing. HRC fuses also have their place and it is as well to remember that, the simpler the scheme, the more reliable it is likely to be and the cheaper to maintain.

Simplicity, however, is not always possible. Large works systems tend towards complexity and often justify centralised control with mimic diagrams to assist in operation. The indicators must, however, be automatically set as hand-set indicators introduce too great a chance of error.

* "Electrical Installations for Large Industrial Projects."

Switchgear

Much of the switchgear installed in industry today is hardly ever used and, over a 20-year life, would be hard put to justify its existence. In many cases cheaper isolating and protective devices such as h.r.c. isolating fuses could serve equally well. Oil-filled gear is, at present, the cheapest but its days are numbered for industrial use. Up to 11 kV, air-break gear is adequate, but reliance on air insulation alone for busbars is not to be recommended. At 33 kV and above, outdoor gear is to be preferred and the need to keep away from oil is not so great. Even here, it may be possible to get further away from the fire risk inherent with oil by the introduction of gas-breakers, using sulphur hexafluoride, in the near future.

Transformers

Transformers fall into two groups; those for h.v. conversion and those, usually not exceeding 1,000 kVA, for supplying plant. The former are better installed out of doors in their own compounds to avoid the risk of an oil fire spreading. It may be that oil will one day be superseded by the gas, sulphur hexafluoride, as a coolant. For indoor use the "dry" air-cooled type which have been made possible by the development of improved insulating materials are on the way to replacing oil-cooled units. Transformer losses on no-load are an important item of running costs and the introduction of grain oriented core iron has resulted in reductions of as much as 30% in no-load losses at no greater cost. There is clearly no point in using transformers with older type iron.

Large transformers for such duties as arc-furnace supply may be water-cooled and with a second tapped auto-transformer in the same tank.

Conversion Equipment

Where d.c. is needed, the choice lies between motor-generator sets, such as Ward-Leonard and Ilgner, mercury arc rectifiers and semiconductor rectifiers. Though m.g. units are still of importance in high-speed reversing mill drives, the grid-controlled mercury arc rectifier is beginning to replace them. For electrolytic and furnace duty, the semi-conductor rectifiers are today predominating. A single plant of 600,000 A capacity using selenium rectifiers for electrolytic tin deposition has been in operation since 1957.

Motors

The majority of motors are of the induction type but, above a few thousand horsepower, the synchronous motor is cheaper in first cost and is mechanically better; moreover, it can be used for improvement of power factor. Motors of up to 12,000 h.p. may be started direct-on-line but the high currents impose large mechanical forces and this must be allowed for in design.

Safety and Maintenance

The larger the installation the greater do the problems of maintenance and safety become. There are two ways of increasing an operative's safety. One can educate him into taking care or one can prohibit him from danger areas by barriers. Broadly, the former is used for the technician with electrical knowledge and the latter for the layman and labourer. The teaching can and does fail where it only deals with the safety aspect and does not explain how the hazards arise. There is much to be done in both aspects in this country and, generally, the problem is better dealt with in the USA.

In regard to maintenance this is a matter of both education and time allowance. The maintenance electrician who has served an apprenticeship is a useful man but, in future and with the increasing use of electronic equipment, his training must be backed with technical education. In regard to time, it is an expanding practice to work "round the clock" on large engineering projects which makes routine maintenance a problem to organise. It can be done but it needs good co-operation and careful planning.

Design for C.T.R. Research

ENGINEERING aspects of plasma physics were the subject of a lecture at a joint meeting of the Supply and Electronics and Communications section of the IEE last week, when two UKAEA engineers* dealt with problems that arose. Plasma in this context is a hot ionised gas such as is used in experiments in controlled thermonuclear reactions.

After discussing the principles of using magnetic fields to keep hot gases away from the walls of reaction vessels, the lecturers passed to the characteristics of a plasma which influences engineering design of research equipment. Factors such as pressure balance, temperature, radiation losses and heating processes are involved. Typical of the type of problem which arises is that of damage to walls of the containment vessel by unipolar arcs on a metal wall, and thermal shock on an insulating wall.

The range of engineering problems that is encountered in this sort of work was illustrated through a number of machines that have been built already. One notable machine is the "toy top" multi-stage compression mirror machine at the Livermore laboratories of the University of California. This recently gave containment times of one millisecond for ions at a temperature of 3·5 million °C. To operate the machine requires accurately timed magnetic fields changing at a relatively slow rate—something of the order of several milliseconds. The current supply for these is taken from capacitor banks. Another American machine, the DCX 2 mirror experiment which has been built at Oakridge, requires d.c. supplies of the order of 10 MW for its magnet, and 1 A at 600 kV for the equipment which injects ions into the apparatus.

Turning to equipment in use in the UK, the linear pinch and cusp experiments at Harwell are examples of fast current rise times being required; of the order of 10 microseconds to 20 microseconds. Still faster is an "ultra-fast pinch" at Harwell, which has a stored energy of 50 joules and a current rise time of 5×10^{-9} sec.

Much of the engineering work in plasma physics research is associated with problems of energy storage, of materials and of switching. Scaling factors are such that many experiments can only be carried out on large-scale equipment, and this has enforced the use of high voltages for experimental work. Since experiments are only required to have a limited life, something of the order 100,000 to 1 million pulses, considerable economies are possible by departing from normal power engineering practices.

* "The Engineering Aspects of Plasma Physics," by R. Carruthers, B.SC.(ENG.), A.M.I.E.E., and D. L. Smart, B.SC.TECH., A.M.I.E.E.

Making the best use of Engineers

TECHNICIAN DEFINED AT GUILD CONFERENCE

THE general feeling that the professional engineer's remuneration is insufficient and that he does not have enough chances to become a member of the board of management overshadowed a conference on "The Professional Engineer—His Employment and Development," organised by the Engineers' Guild last week. Sir Hugh Beaver, president of the Guild, opened the conference, at which three papers were presented and discussed.

Presenting his paper on the engineer in management, Mr A. R. Cooper, Member for Operations and Personnel, CEGB, said there is no general pattern of the structure of management boards, and it is possible for some engineers to find their way to the top. It could well be that these men would find their way to the top in any profession, but it shows that being an engineer is not in itself necessarily a handicap to a man who wants to become a manager. Although engineering is in itself a form of managing, it is possible for a man to be a good engineer without being a good manager.

Apart from all other qualities, a manager must possess a good deal of "horse sense," it is a prerequisite for that vast multitude of managers who will have to make value judgments on insufficient data. The irrationality of the human animal, especially when he is organised, is something the potential manager will have to learn to accept without bitterness or a sense of frustration. The manager of men should be interested in what makes men tick, how different people react to varying circumstances and what makes them compatible or incompatible in a working group.

Engineering training and experience are valuable assets for a man who hopes to become a skilled manager, but they are not enough. The engineer has essentially to deal with the shaping of inorganic material, but the manager is more directly concerned with the manipulation of human material. Comparing an engineer to a precision tool with a sharp cutting edge, he said management is much more of a blunt instrument, a far less definite exercise in which the best has often to be sacrificed for the good.

"There are undoubtedly many engineers who wish to become managers solely because they see it as the one way in which they can obtain adequate remuneration," said Mr Cooper.

Although it can be argued that the skilled engineer plays a vital part in the maintenance of an increasingly mechanised society, that his financial rewards should be appropriate to his importance, there are few exceptions to the maxim that top salaries of even the most outstanding engineers fall significantly below board level. Skilled engineers should not be driven by financial pressure to seek managerial posts for which they may not be well suited.

All doors are open to the engineer who wishes to become a manager, but, in order to qualify, his spread of interests must be wide. He should strive to include subjects other than engineering within his ambit, and if he desires to be considered for management then he must create the impression he is managerial material.

"If engineers behave like artificers they will be treated as artificers. If they want to be regarded as something potentially higher in the business hierarchy they will have to widen their spread of interests and make it obvious to the world that it is part of their creed for this widening to be encouraged," concluded Mr Cooper.

Engineers' Social Obligations

"The engineer is the aristocrat of the twentieth century," said Viscount Chandos, chairman of AEI, presenting his paper on "The Engineer in Society." Explaining his meaning, Lord Chandos said that in the material field, and he emphasised the material field, the engineer has both the training and knowledge to engage in speculations about the material future of mankind and the means of bringing these speculations to life.

Just as the great landowners of the past had the means of bringing waste land to use, together with skill and experience in agriculture to bring rescue to the people, so today, the engineer, through infinitely more complex processes and calculations, holds out to mankind in the material field a future in which the word starvation should become obsolete; the word under-developed, an anachronism, and in which unemployment would cease.

The continual debasement of the English language is to be deplored, and engineers should devote a definite part of their time to its study so they could convey their thoughts to their fellow men.

Aristocrats of previous ages were linguists, and it is essential if engineers are to be part of the aristocracy they, too, should familiarise themselves with foreign tongues and not need to rely on translations to put them in touch with the teeming thought of the modern world.

It is the task and duty of the aristocracy to turn part of their highly developed minds, a significant part of their time, leisure and thought and some of the ingenuity which they devoted to their material prosperity to a study of the mistakes man has made in planning his life.

Lord Chandos said: "I wish I really had faith in the progress of man, but I find it difficult to believe in 1961, that when mankind, who have become so ingenious and who have to their credit so many startling discoveries, should, at the end, be found so obdurately stupid.

"Today, we stand convicted not only of progressing quickly in the things that do not matter, but of standing still, and even retrogressing, in the things which do," he concluded.

The Technician—a Definition

During recent years there have been many attempts to differentiate between the engineer and technician, said Mr D. J. Mann, Director and Head of Personnel Division, Unilever, when he introduced his paper of the "Engineer and Technician." In his company, he defines a professional

engineer as one who is competent by virtue of his education, training and experience to originate scientific methods in analysis and solution in engineering problems. His work requires original thought and judgment and ability to supervise and instruct others. He should also be capable of contributing to the development of engineering science. On the other hand, the technician is one who applies proven techniques first established by the professional engineer. He requires education, training and experience to an extent sufficient to enable him to understand the reasons and purposes of a task for which he is responsible. There are many engineers in responsible jobs who have qualifications below, some well below, the level of chartered engineer. Much of the professional engineer's training has in the past been along the very same route followed by the man who stopped—willingly or otherwise—at a stage short of professional qualification. Are they such different people? he asked. Is it not reasonable to expect an overlap area in function and interest? Alternatively, are examination marks, say, of 49% and 51% sufficiently discriminating to make it possible to say one is a technician and the other an engineer? Whereas in the 1950s it was true to say that over half the members of the major professional engineering institutions qualified via part-time courses at technical colleges, it is now not merely difficult but in some cases almost impossible to qualify in this way, and future professional engineers will have to take their examinations after full-time sandwich courses of university degrees at first degree level. This does not mean that some technicians do not follow closely on the heels of engineers. In short, the dividing line, at least on the academic side of their training, is not particularly narrow.

Mr Mann summed up on six main points. The urgent need for more intellectually first-class engineers and better-trained technicians. Government, technical colleges and industry's efforts will result in higher qualifications for technicians. Many technicians employed in engineering are distinguishable from the professional engineer only in that they failed the professional examinations. A large area of work could be done by either chartered engineers or technicians, and the professional engineer is expected to make contributions in the fields of original thinking, planning and direction; integrated teamwork between the two is increasingly important. Finally, if the previous concept is accepted, the managerial ability of the professional engineer becomes of great importance.

DISCUSSION

Feelings that professional engineers had not adequate representation on boards of management ran strongly in the discussion, the general concept being that a chartered engineer's qualifications and intellect fitted him for management, which, was thought, should be an idea inculcated in universities.

Regarding the engineer's social responsibility, Sir Hamish MacLaren, IEE president, said chartered engineers should take a part in and interest in leading and helping to form opinion. There was a general attitude that greater distinction between professional engineers and technicians could be obtained if the standard of university degree examinations were raised. Sir Hugh Beaver, Guild president, said that if the engineer wanted to be considered for management he must change his attitude and prepare himself for the added responsibility.

Quality Control for Sheet Metal

TRANSISTORISED logical units are applied to the grading of sheet steel and tinplate in an English Electric Co. development announced recently. This is a classifier, used for sorting sheared sections of cold-rolled strip and rejecting faulty pieces. While faults such as pinholes, departure from gauge and poor surface finish can be detected during inspection of the continuous strip, the final sorting remains to be carried out after shearing.

The sheet classifier stores information on strip quality obtained at the time of inspection and uses it when the sheet is cut and ready for sorting into piles. The information is stored and processed by Datapacs (standard transistorised logical elements).

From these standard elements, a sheet classifier system of any size and complexity can be built, for a line of any speed, and with cut length ratio of as much as 10:1. The first units will shortly be installed on No. 5 cut-up line at the Abbey Works of the Steel Company of Wales Ltd. and on two cut-up lines at Richard Thomas and Baldwins Ltd., Ebbw Vale. A further unit is to be installed in a South African steelworks.

The unit at the Abbey Works will be on a steel line operating at 700 ft/min with cut lengths ranging from 40 in. to 180 in. Sorting will be into "pass" and "reject."

On two tinplate lines at Ebbw Vale, both operating at 1,000 ft/min, with cut lengths ranging from 18 in. to 42 in., sorting will be into four piles: sheets with pinholes, off-gauge material, other rejects and prime sheets.

The Datapac standard logical elements are in the form of standard plug-in packages. Each package contains a number of elements capable of performing a specific logical function, e.g., shift register, "and" gate, store, etc. Each element can operate from the output of the preceding element, so that a series of elements can be made up to form any desired logical system.

Faults detected by the inspection instruments are stored in the first shift register at a point corresponding to the instrument position. Shift pulses timed to the conveyor movement are applied to the register, so that the fault signal moves within it, in time with the movement of the faulty section of strip on the shearing line. The signal transfers from the register to "store 1," when the fault passes the shear position. This then indicates that the next sheet to be cut is a reject.

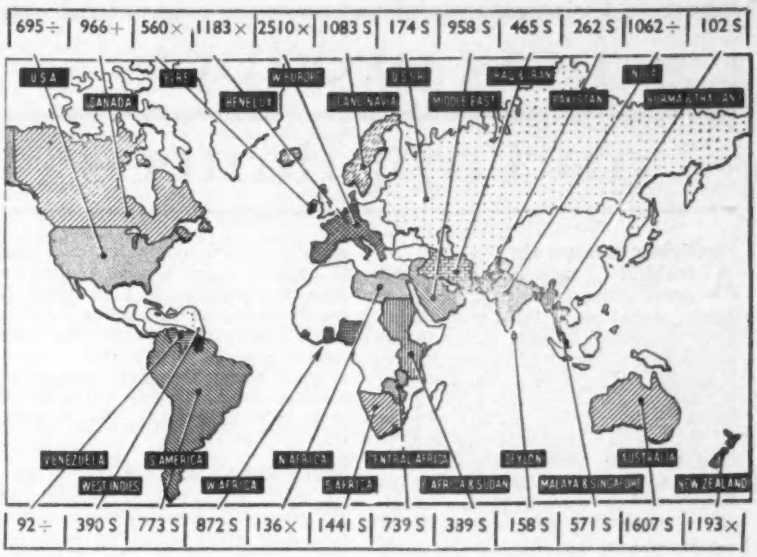
When a sheet is cut, this is detected by a device which causes the signal to be transferred from "store 1" to "store 2." This indicates that the last sheet cut is reject. The leading edge of this reject sheet is now detected by one of the leading edge detection photocells, and transferred to a suitable position in the second register. The signal of the reject sheet is then shifted within the second register so that it appears at a reject gate just before the leading edge of the sheet reaches the gate. The signal is used to prepare the gate control to reject the sheet when its leading edge reaches the gate photocell.

Two leading edge photocells are used after the shear to cover the range of sheet length used. One is used for short sheets, the other for long sheets.

Normally, mechanical reject gates are used, but more complex methods, such as overhead magnetic conveyors with variable drop-off points for the piles, can be operated with the new system.

Distribution of Exports in £'000's Sterling

×=over 25% increase
+=10% to 25% increase
S=10%+ to 10%−
−=10% to 25% decrease
÷=over 25% decrease
on previous year's figures.



EXPORTS IMPORTS *February*

WITH a shorter working month, exports of electrical goods during February, at £23,762,702, were nearly £3¼ million in value below January's record total; yet the figure is still slightly above the monthly average for 1960—a good omen. The heavy plant side maintained high levels on most items, particularly for transformers and switchgear, while among the domestic appliances, exports of refrigerators and food mixers were higher than in January, but washing machines suffered a sharp drop and reductions were recorded for vacuum cleaners, irons, space heaters and cookers. Of the fans sent abroad, ceiling type accounted for £135,155 of the total.

Among the cable exports for the month, those for p.v.c. covered wires and cables were again slightly higher in value than the rubber-covered type, indicative of the trend.

Australia was our best customer for the month, taking goods to a total value of £1,607,579, South Africa following with £1,441,213.

Among exports to Western Europe, those to West Germany alone amounted to £729,748—double that of a year ago.

The value of imports of electrical goods, at £4,878,006, is slightly down on the previous month's figure; the largest proportion, £1,448,617, again coming from the USA, with West Germany supplying the next largest amount, £831,211, and the Netherlands, £508,648 (over £200,000 down on a year ago).

Description	Exports Value (£)		Imports Value (£)	
	Feb. 1960	Feb. 1961	Feb. 1960	Feb. 1961
Generators				
Diesel up to 200 kW	435,465	294,812		
Diesel over 200 kW	85,275	410,867		
Steam turbine driven	113,308	26,535		
Water and gas turbines	451,687	924,981	47,608	121,565
With i.c. and other prime movers	15,387	86,206		
Generators up to 200 kW	98,759	105,883		
Generators over 200 kW	39,271	49,852		
Generator parts	468,322	286,900		
Motors, f.h.p.	263,044	306,834		
Motors 1-250 h.p.	513,965	504,341	170,973	283,025
Other motors	399,793	366,409		
Motor starters and controllers	289,477	39 ,470		
Convertors and rectifiers	200,108	128,666	236,066	233,953
Transformers	887,636	803,464		
Switchgear, to 200A, mv	411,528	463,817	153,377	245,626
Switchgear, other	1,306,987	1,134,176		
Total, Electrical Plant	*5,984,012*	*6,294,273*	*608,024*	*884,169*
Batteries, primary and parts	668,070	633,858		
Lamps filament, over 28 V	96,345	105,064		
Lamps filament, under 28 V	35,475	34,292	82,563	103,438
Fluorescent tubular lamps	64,034	81,401		
Other lamps and parts	69,302	107,053		
Radio and electronic gear	3,264,015	3,909,365	1,412,567	1,312,475
Telephone and telegraphic equipment	1,750,898	1,556,961		
Cookers	43,758	49,756		
Other cooking appliances and parts	130,371	119,948		
Space heaters	29,171	24,065	150,521	199,969
Water heaters	36,440	42,515		
Other heaters and parts	131,650	193,105		
Electric irons	57,476	78,665		
Vacuum cleaners	144,550	193,619		
Floor polishers	51,788	63,679		
Food mixers	65,183	87,973		
Washing machines, domestic	386,965	471,026		
Dryers	45,697	52,677	293,818	81,050
Washing machine and dryer parts	92,874	156,333		
Domestic refrigerators and parts	709,101	708,840	494,575	152,570
Other appliances and parts	223,103	419,630		
Total, Domestic Appliances	*2,150,127*	*2,661,831*	*938,914*	*433,589*
Portable power tools	250,465	307,485		
Arc welding plant	132,023	103,226	75,114	119,776
Resistance welding plant	70,651	39,955		
Electric furnaces	69,046	59,106		
Signalling apparatus	114,103	164,848		
Commercial instruments	187,504	190,286	82,025	104,313
House service meters	162,489	175,693		
Wiring accessories	232,811	235,746		
Fans	97,933	167,730		
Lighting fittings and lanterns	302,257	394,277	129,862	139,366
Other lighting equipment	88,577	94,196		
Telephone and telegraph cable	457,816	447,013		
Paper insulated cables	694,495	496,956		
Rubber insulated cables	273,983	352,646		
Thermoplastic insulated cables	317,821	357,401		
Winding and similar wires	100,818	219,407		
Other cables and wires	262,983	214,661		
Total, all cables and wires	*2,107,916*	*2,088,084*		
Accumulators and parts	260,596	410,957		
Insulating materials	249,124	183,098		
Industrial electronic control gear	120,596	170,878	33,805	82,930
Electrical ware	102,795	116,161		
Permanent magnets	58,245	83,753		
All other articles	2,986,923	3,379,125	1,695,947	1,697,950
Total	21,676,332	23,762,702	5,058,821	4,878,006

new products and appliances

Firelighter uses hot air

A DOMESTIC appliance which will ignite open grate solid fuels by means of hot air is the Creda electric firelighter which is being shown at the exhibitions. It consists of an element over which air is forced by a fan. The temperature of the air is raised to 700°C, which causes ignition to fuel adjacent to the nozzle. This appliance can be used to ignite coal, certain grades of coke and patented fuels, and ignition times vary from 4 min to 15 min, according to the fuel. The element has a 635 W loading and the shaded-pole motor 15 W. The fan motor starts immediately the appliance is connected to supply and the element is controlled by a switch on the motor housing. The firelighter is finished on the exterior in stove enamel and stands on an aluminium painted-wire support. *Simplex Electric, Creda Wks, Blythe Bridge, Stoke.*

Flameproof push-button switch

FEATURE of a new flameproof push-button switch intended for fire alarm systems and emergency stopping of machinery, is the incorporation of a button-locking device. This ensures that once pressed, the button remains in the operating position until reset by a key. As an alternative to the locking device, the unit can be supplied with a conventional glass cover which, when broken, releases the button to operate the control circuit. Either normally open or normally closed contacts can be fitted, typical ratings being 5 A at 240 V a.c. non-inductive and 0·5 A at 25 V d.c., inductive. The cast iron switch body has two gland or conduit entries up to 1 in. E.T. *Heyes and Co. Ltd., Wigan.*

Conveyor emergency stopping

IMMEDIATE stopping of a conveyor belt under emergency conditions is made possible by a photo-cell control device now available. A light beam is directed along the conveyor and focused on a photo-cell at the far end. Thus, an operator is able to stop the conveyor from any position along its length by simply passing his hand across the beam. Single units can be used with beam lengths of up to 75 ft, conveyors having a length greater than this being accommodated by overlapping a number of units. *Hird Brown Ltd., 244 Marsland Rd, Sale, Ches.*

Smoke density monitor

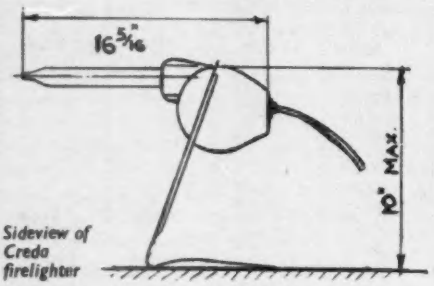
A NEW smoke density monitor consists of a photo-electric measuring head used in conjunction with a control unit and pen-recorder. The instrument samples the percentage of coarse dust and grit (from 20 microns) at predetermined intervals of about 15 min, recording the results on a 24-hr chart. If the flue-dust burden exceeds the statutory limit, an alarm is automatically raised. The chart presents readings of percentage obscuration/minute relative to a vertical surface exposed to dust. *Evans Electroselenium Ltd., Halstead, Essex.*

Radiant fire has coal effect

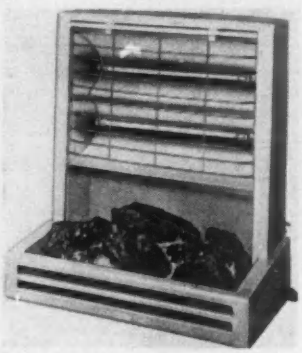
THE newest Morphy-Richards radiant fire, the "Solway," utilises the coal effect. The two 1 kW elements each have separate switches enabling the coal effect to operate without the radiant section. The chromium plated reflector plates have been designed to project radiant heat rays over a wide area. The "Solway," which is available on a.c./d.c. voltage ranges, is 22 in. high by 20 in. wide by 11 in. deep. It can be screwed to the floor as a permanent fixture by means of holes in the base. This model, SOL/20, will retail at 12 gn. *Morphy-Richards (Cray) Ltd., Conduit St, W.1.*

Atlas price changes

ATLAS Lighting announced price increases in their ranges of commercial glassware, pendant, wall bracket and flush ceiling fittings. The increases took effect from Monday and the company say that there are no increases in their "Chelsea," "Finlandia" and "Forest" ranges. *Atlas Lamps, Thorn Hse, Upper St, Martin's La, W.C.2.*



Sideview of Creda firelighter


Morphy 2 kW coal effect radiant fire

Water heater is compact

A COMPACT water heater which can be mounted in three ways is the "Kent," which is claimed to give instantaneous heat. It is 7¾ in. long by 5 in. wide and 2¾ in. deep and can be fitted either direct to the cold water supply or as an extension to a tap by means of a chromium horizontal extension pipe, or as a complete shower unit with either a fixed or hand-held spray. The heater produces water up to a temperature of approximately 150°F at the turn of the tap which controls both temperature and flow by means of a newly evolved valve system. Of standard a.c. voltage only, there are both 3 kW and 4 kW models. The heater is finished with durable cream plastics cover and chrome fittings and sells at £13 11s 6d including tax. *ICG Ltd., The Pantiles, Tunbridge Wells.*

Portable electric drainage pump

SMALLER and lighter than its predecessor, the "Sumo Minor" portable electric drainage pump is at the same time robust and designed to give long life under arduous working conditions. Having a body of sea-water resistant light alloy, with parts subject to abrasion made of cast-iron, the pump's wide range of application includes building site drainage, emptying excavations and also pumping sewage effluent and water-borne slurries. Driven by a 2 h.p. 2,750 r.p.m. motor, typical pumping capacities are 3,000 g.p.h. at 52 ft and 6,000 g.p.h. at 29 ft. It is said to be able to maintain a water level of only 2 in. and to deal with an air/water mixture continuously. Power supply at 110 V or 550 V a.c. is fed by four-core screened flexible cable, two cores being utilised for a thermostat trip circuit. The pump weighs 90 lb and has a delivery outlet suitable for a 2 in. bore hose. *Stone-Chance Ltd., Schomberg Hse, 82 Pall Mall, S.W.1.*

The simple and light "Sumo Minor" drainage pump for building sites

Three-heat blanket

MANUFACTURED by a process which welds the entire assembly into one inseparable unit, the latest "Dreamland" electric blanket has triple heat control. The manufacturers claim that the use of this welding process makes it impossible for any two sections of element to close together sufficiently to cause overheating. The single-bed size which retails at £6 14s has a maximum loading of 80 W and the double blanket, costing £9 14s, has 130 W maximum loading. *Easipower Appliances Ltd., High St, Southampton.*

Coal-effect fire

INFRA-RED heating combined with a coal-effect presentation in a design to match with a contemporary décor is the achievement of the Sofonoflame range, the first model of which is a 1½ kW design. The coal-effect fitting is in the upper half of a rectangular-shaped matt black or chocolate brown steel casing. The lower part of the appliance contains two 750 W silica-glass-sheathed infra-red elements, set at an angle in a double-parabolic copper-anodised fluted-aluminium reflector. The appliance is supported on a one-piece steel plinth which incorporates a two-screw adjustment to permit the fire to cover a range of existing fireplace sizes. Washable plastics material, fibreglass reinforced, is used for the coal, with a projected flickering flame effect obtained from a 60 W lamp. Each element is switch-controlled. Dimensions are 26 in. wide by 7 in. deep, with overall height adjustable between 21⅞ in. and 24⅞ in. *Sofono Electrical Division of Federated Foundries Ltd., Stratford Pl, W.1.*

MULTI-MOTOR CONTROL

TO cater for diverse individual requirements of industrial motor control, manufacturers are continuously seeking to extend the versatility of their equipment. An approach adopted by the English Electric Co. in introducing their new "Multi-motor Control Centres," is to house in a single cubicle starter gear for a number of motors covering the fractional h.p. range right up to 400 h.p. Three methods of mounting have been adopted depending whether the starters are for motors in the range having a maximum rating of 25 h.p., 100 h.p. or 400 h.p. For the smallest motor range, the starters are mounted in banks to form a swing-out, safety interlocked, unit, while for the medium sizes draw-out chassis compartments are used, these have specially designed 140 A three-pole isolators. The largest starter units, which include auto-transformer, rotor resistance and star-mesh types, are allocated with fixed panels on the control centre cubicle. They incorporate "Superform" isolator switches which interlock with the hinged door of the panel. Besides giving operating convenience, other advantages claimed for the system are economy in floor space, ease of access and the facility to rearrange the layout as required.

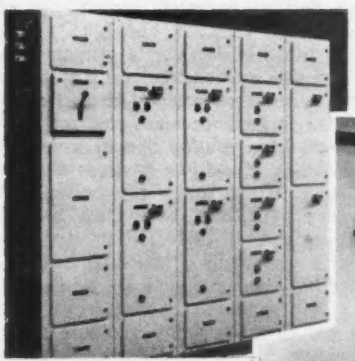
By contrast, the new "Unitactor" control board by Allen-West, are built up to customer's requirements by bolting together a number of basic units. Each basic unit incorporates either direct-switching, reversing or star-mesh starters with individual isolation and h.b.c. fuses. Optional extra features include ammeter, pilot lamps and local push-buttons. In addition, facilities for phase-to-neutral or separately controlled supplies can be provided.

Progress continues also in the design of individual motor starters, thus, the Electrical Apparatus Co. have put on the market a new range of oil-immersed a.c. starters. Available for both floor and wall mounting, this "QOD" range covers star-mesh, stator-rotor and auto-transformer types. Among special features claimed for the design are damp- and dust-proof enclosure incorporating simple coin slot fastening, with easy access for maintenance by lowering the oil tank. Extra accessories include an interlocking isolating switch and overload and single-phasing protection unit.

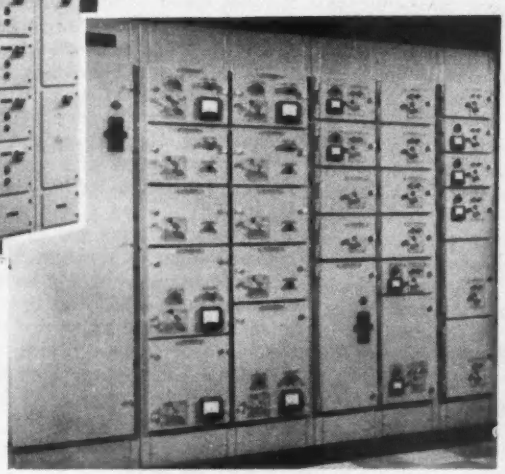
The English Electric Co. Ltd., English Electric Hse, Strand, W.C.2.

Allen West and Co. Ltd., Brighton 7.

The Electrical Apparatus Co. Ltd., St. Albans, Herts.



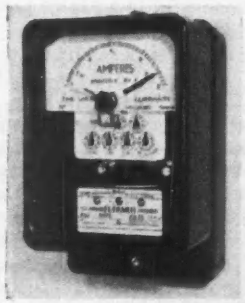
▲ *The Allen West "Unitactor" multi-motor panels, utilise basic standard units*



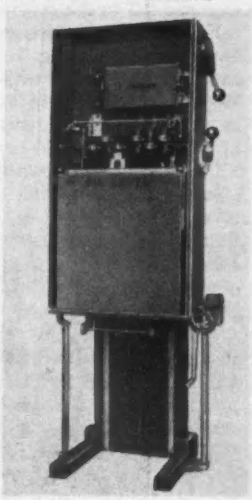
Centralised control is possible with the English Electric multi-motor control centres for motors ranging from fractional h.p. ratings to as large as 400 h.p. ▶

Combined kWh and thermal demand meter

INTENDED primarily for overseas markets, a recently announced instrument combines a normal single-phase kWh meter with a thermal maximum current demand meter. The latter is a square law device, the pointer being actuated by an ambient temperature compensated bi-metallic strip arrangement. This is heated by mains current passing through a plastics embedded, copper alloy element. A toothed sector on the bi-metallic strip engages light alloy gearing to drive a pointer which in turn pushes round the demand indicator pointer. The indicator pointer is viscously damped by silicone grease sandwiched between two steel plates, thus ensuring that it remains at the maximum recorded current position under possible conditions of shock or vibration. Time lag for the driven pointer to give 90% indication is 16 min. Nominal current ratings are 5 A to 60 A, with 50% overload. *Ferranti Ltd., Hollinwood, Lancs.*



◀ *Ferranti kWh meter incorporating thermal current demand ammeter. This instrument is intended for overseas markets*



The EAC oil-immersed stator and rotor starter unit, size 30 QOD has a compact construction ▶

Advice on Fuel Policy

GUIDANCE to member countries on framing fuel policies in the light of the European outlook as a wnole has been offered by the council of OEEC. Governments of member countries are urged to take into account a number of conclusions, of which the outstanding one is that there will be no lasting shortage of energy supplies in Western Europe before 1975. Freedom of choice for the consumer is stressed as being important, and "everything should be encouraged that may lead to more rational use of energy."

Expansion of indigenous resources should be developed or encouraged so far as this is economically sound. In particular, Governments should permit, as far as possible, a more flexible price policy for coal. The greatest importance should be attached to the transformation of coal into what OECC calls secondary energy, e.g., electricity.

It is recommended that the exercise should be undertaken of determining the "ideal" situation, in which the prices of different forms of energy reflect the costs and scarcities of each type of fuel. Then taxes, charges and customs duties should be designed so that they do not lead to preference for a less economical form of energy in any situation than would be appropriate in the ideal case. Governments are called on to refrain from preventing sound economic management of production, transport and distribution of the different forms of energy, and bodies controlled by public authorities "should normally make sufficient provision in prices for return on capital."

Several recommendations are directed especially at coal-producing countries. These are recommended to watch that action taken to overcome the technical and social difficulties of the mining industry does the least possible damage to the structure and economic development of the supply and use of energy as a whole.

Apart from pressing on members these recommendations, the OEEC council is arranging increased international consultation in the energy field, and continuing co-operation with other international organisations.

CYCLONE BOILER EXPERIENCE

AT the 700 acre Wilton works of ICI, process steam is provided from large high-pressure boilers. There are five of these, the most recent being a 530 klb/hr 1,700 lb/sq in., 1,065°F unit which supplies a back-pressure set of 27·2 MW capacity. This boiler and its accompanying set are identical in rating with No. 4 boiler and set; but there is an important difference that the furnace is of the cyclone type. In a paper* presented to the Institute of Fuel last week, experience with this furnace, one of the first to be installed in this country, is described.

The first commercial cyclone furnace came into operation in the USA in 1944. At Wilton, a German-developed design is used, the furnaces consisting of two cylinders each 10 ft diameter by 16 ft long. Each cyclone is cooled by tangent wall tubes of 1¼ in. outside diameter, shaped to form a cylinder, and provided with top and bottom headers connected into the boiler circulation system. The wall tubes of the cyclone are studded, with chrome-ore refractory rammed between the studs. A slot is provided along the bottom of the furnace through which molten slag can fall to the secondary furnace floor.

Each cyclone is designed to carry loads from 20% to 60% of boiler m.c.r. with satisfactory slag flow for all coals except those with the highest ash-fusion points. With such coals, slag flow may be satisfactory only at loads near m.c.r. In operation, primary air and coal enters at a velocity of 16 m/second and secondary air at 120 m/second, irrespective of boiler load. Combustion is almost complete within the cyclone, and heat absorption of the cyclone surfaces accounts for about 14% of total heat released in the boiler. Such is the intense turbulance achieved in the cyclone that satisfactory combustion is obtained with only 10% excess air, with consequent improvement in efficiency.

Coal is ground as required in four mills and blown straight into the cyclones, primary air being obtained at 655°F from the air heater, and mixed with cold air to give a constant mill output temperature of 257°F. Only 32% of the milled coal passes through a 200 mesh screen, compared with 71% for a corresponding p.f. boiler.

Slag flows from the discharge slot of each cyclone to the secondary furnace floor where there is one tapping hole. This is viewed by a closed-circuit television camera. Slag falls into a water-filled quench tank, supplied with jets that break up the slag stream into granular form.

Operational Experience

The boiler came into operation in the autumn of 1959. For some time it was used for steam supply only, but since January, 1960, it has operated on base load, supplying the back-pressure turbo-alternator. After 4,687 total steaming hours, the boiler was shut down because of failure of the slag-quenching system. This ended a continuous run of 2,500 hours. Two further enforced periods out of service have since occurred, at 5,283 hours and 5,570 hours, respectively. On the first occasion a cyclone tube failed as a result of fire-side erosion, and on the second occasion three cyclone tubes were perforated as a result of attack by molten iron formed from the coal slag.

Efficiency figures taken from routine operating records suggest that the boiler has given 92·6% gross thermal efficiency compared with 91·9% for a p.f. boiler. The gain is largely in respect of heat being lost by dry products of combustion and excess air. The auxiliary power consumption of a cyclone-fired boiler on balanced draught firing is about 19% higher than for a similar p.f. boiler.

In their conclusion, the authors emphasise how smoothly commissioning of the unit was obtained. Initial difficulties experienced were not associated with cyclone firing. As mentioned, there has been some difficulty with iron attack, but it is thought that this has been overcome by modification of the cyclone tapping slots. One of the advantages of the cyclone-fired boiler is the high ash retention in the furnace, and data so far available indicate ash retention of between 80% and 85%. Moreover, the dust leaving the boilers contains less coarse particles than from p.f. boilers.

* "The New Wilton High-pressure Cyclone Boiler." By E. Holmes-Smith, M.A., A.M.I.E.E., M.INST.F., J. Lister, B.SC., A.R.I.C., and P. V. Liddell, B.SC.(ENG.). The first two authors are with ICI; Mr Liddell is with Babcock and Wilcox.

News of the Week

B.o.T. Reject B.E.A.M.A. Plea

Call for 10% deposit on H.P. falls on deaf ears

BEAMA's plea for a 10% initial deposit for hire-purchase on electrical appliances has been rejected by the President of the Board of Trade. This became clear during a House of Lords debate last week on the electrical industry. Following discussions with BEAMA representatives, the President has said he is "not convinced that a further relaxation (that is below 20%) is desirable."

However, the Government recognise that frequent changes in level of control are bound to be a dislocating factor to trade.

The statement about this decision came near the end of a debate which had discussed the performance of the electrical manufacturing industry and its needs in relation to Government action. It was initiated by Lord Merrivale who said that the industry deserved special consideration by the Government, since the country needed an efficient and prosperous electrical industry. The industry, he claimed, had proved its vitality by the rapid rate of technical advance and the improved productivity it had achieved.

He urged the Government to initiate an organisation similar to the UK Railway Advisory Service which would group the CEGB, Board of Trade and industry for the purpose of advising countries who require it on matters affecting power supply installations, including transmission.

Lord Citrine spoke in the debate of the close co-operation that existed between all sections of the electrical industry, which was "very conscious of its public responsibility." He said the industry had taken voluntary steps far beyond any legislative compulsion to ensure the safety and efficiency of its products. The supply industry and the manufacturing electrical industry were so closely interdependent that it would be "unthinkable" if they were to regard themselves as operating two separate policies. Both sides tried to subordinate points of view and to collaborate in the general interests of the public.

In a direct reference to the recent speech in which Mr R. Maudling suggested that the best way to stabilise a home market was to get a good export trade, Lord Citrine called such arguments "putting the cart before the horse." It was necessary to cover overheads of large scale production on the home market in order to compete abroad.

Other speakers commented on the interference with the industry's planning caused by changes in Government schemes such as nuclear power and railways.

Lord St. Oswald, replying for the Government, said that the CEGB's requirements had enabled electrical manufacturing firms to become specialists in three fields; large generating sets, supercritical power stations and nuclear power stations. He quoted leaders of the industry as speaking to him in most appreciative terms of the CEGB, describing it as "an understanding operator —knowing well how much research and development costs, and taking it fully into account."

It had been suggested that to avoid waste in preparing tenders, contracts should be awarded on a rota basis instead of by tender. While the CEGB had welcomed steps that manufacturers had taken to streamline organisation and improve efficiency, as a sound business precaution the Board had to continue to seek competitive tenders wherever possible.

Hampshire to examine Calshot proposal

HAMPSHIRE planning authority has not yet taken sides on the CEGB's proposal to build a 2,000 MW power station on green belt land at Calshot, Southampton Water. Sir Richard Calthorpe, chairman, said the authority had insufficient information on which to base a decision at present. At a meeting on Friday the authority appointed a committee to report on the position. The proposal, which follows the postponement of the plan to build a nuclear station at Hamstead, IoW, has already met strong opposition from the New Forest RDC.

NORTH WESTERN TARIFFS UP

INCREASES in all but off-peak tariffs are announced by the North Western Electricity Board to take effect from 1 April. So far as domestic, farms, commercial and other block tariffs are concerned, the Board is to discontinue the 0·01d/unit rebate it introduced some time ago, and the 1d/unit rate will be increased to 1·15d. In the domestic tariff and associated tariffs, there is also to be a change in the number of units in the primary block charged at 5½d. This will become 50 units/room/quarter for the first five rooms, then 10 units/room/quarter up to 16 rooms.

Maximum demand charges in commercial and industrial m.d. tariffs will be increased by 5s/kW/year, while the unit charges are to go up by 0·01d/kWh. The Board has not increased tariffs since July, 1957. The present increase is made necessary by the rise in CEGB bulk supply tariff, the cost of coal, and increasingly heavy capital expenditure.

New Minister for overseas assistance

BRITAIN is offering an increasing amount of technical help overseas through the supply of trained people and special equipment. In future, all this work is to be co-ordinated by a new Government department, entitled the Department of Technical Co-operation.

Announcing the new department in the House of Commons last week, the Prime Minister said it would be in charge of a Minister of rank equivalent to that of a Minister of State. It would take over responsibility for provision of technical assistance other than major loans, its interests extending to help provided through international organisations as well as that given directly to overseas countries.

EARLY START AT SIZEWELL

SITE work for the new Sizewell nuclear power station, on the Suffolk coast, is to begin on 4 April. This was announced by officials of the CEGB at a meeting at Leiston-cum-Sizewell UDC offices last week when representatives of the Midland projects group of the Board and the contractors, the English Electric-Babcock and Wilcox-Taylor Woodrow Atomic Power Group, met the Council and representatives of the East Suffolk County Council, police and the Ministry of Labour. The contractors expect to be engaged on the project for four to five years. The initial labour force will be expanded to 1,600 by January, 1962, and increase to 2,500 within the following 12 months. The station is scheduled to be operating by 1965.

Chairman of the UDC, Mr H. R. East, commented: "This nuclear power station is not only going to put Sizewell on the map, it is going to add 1,000 people to the population."

The 650 MW station is to be built on a 240-acre site north of Aldeburgh. Technical details of the station and of the contracts placed were given in our 1 Dec. issue.

Opened by Australia's Prime Minister, Mr R. G. Menzies, last week, the Wool Industries Research Association's new building at Leeds has a Crompton Parkinson lighting installation using 5 ft, 80 W fluorescent fittings. Electrical contractors were Shaw, Dale and Co. Ltd.

TRADE UNION MEMBER FOR SCOTTISH ELECTRICITY COMMITTEE

THERE is to be an additional member for the Scottish electricity investigating committee, trades union leader Mr E. W. Craig. This was announced by the Secretary of State for Scotland, Mr J. Maclay, last week, when Scottish MP's debated the new committee and its task. Mr Craig is at present chairman of the general council of the Scottish TUC.

In the debate, Mr Maclay expanded the argument for setting up the committee which he had advanced on its first announcement. He said it was common ground that the North of Scotland HEB had done "magnificent work;" but there had been many changes since it was set up. Today, it had the building of hydro stations of over 800 MW aggregate capacity behind it, a further 500 MW of schemes being constructed and about 500 MW under survey.

The HEB had connected over 90% of the very scattered population of its district through the profits it made selling peak power to the South of Scotland EB. The Board estimated that its rural connections involved it in an annual loss running at about £1¼ million. In 1957, average cost per new connection was £350; today it was £500.

In considering the plans of the HEB, as was his statutory duty, the Secretary of State had to take into account the full complexities of the links with the South of Scotland EB and the varying costs of different kinds of generation. It was wrong to judge the future of hydro-electricity on any one scheme taken in isolation. The requirements of a number of years ahead needed to be considered and technical detail had to be probed more deeply than was appropriate in an inquiry relating to a single scheme, such as Glen Nevis.

The report of the new committee, and the decisions taken on that report, would for some years to come give an up-to-date basis on which to judge the economics of any individual schemes the Board might promote.

Mr Maclay indicated that the public inquiry into the Glen Nevis scheme would proceed at the same time that the committee was considering the general problem of electricity supply in Scotland. To those who feared that he might withdraw the powers given to the North of Scotland HEB to promote economic development and social improvement in the Highlands, he said that an Act of Parliament would be necessary to bring about a change.

Subsequent debate showed strong support for the work of the N of S HEB, although there was some split on party lines as to whether an investigating committee might be worth while at present.

When he wound up the debate, Mr Maclay made the point that the report of the committee would not bind the Government. He was heavily in favour of the Hydro Board's operations, but he was willing to consider amalgamating the North and South Scotland Boards if that would bring benefits to the Highlands and islands. He went on to "deny emphatically" that his decision to appoint the committee had been influenced by the activities of Aims for Industry (an organisation which has been campaigning against hydro-electricity in Scotland).

Brush - Armstrong - Whitworth Electronics Link-up

THE electronics sections of Armstrong Whitworth Aircraft Ltd. and Brush Electrical Engineering Co. Ltd. have been linked to form a partnership known as Armstrong Whitworth / Brush. Brush will be the trading organisation for the new partnership and enquiries will be channelled to whichever of the two companies has the most suitable facilities. Two contracts have already been received by the new partnership. One is for data link equipment for a secret radar installation and the other is for recording equipment for experiments in the detection of underground nuclear explosions.

Chrysler in U.K.

TO expand marketing of Airtemp refrigeration, air-conditioning and heating equipment, and of marine and industrial engines, Chrysler International have now formed a British company with the title of Chrysler Airtemp Ltd., to operate from the Kew, Surrey, factory. Among its directors are Mr P. N. Buckminster, formerly president and managing director of Chrysler International, S.A., Mr E. P. Lions, director, Special Products Division of Chrysler International, and Mr W. K. Bradley, who has been in charge of Region II of Chrysler International Special Products Division, hitherto responsible for Airtemp marketing in the UK and now absorbed by the new company. Mr Bradley will, in addition, be its general manager.

OFFICIAL PUBLICATIONS

Report on Census of Production, 1958. Telegraph and Telephone Apparatus. HMSO. 1s 9d.

ERA Publications:

Z/T120, Stray Losses in Laminated Cores with Particular Reference to f.h.p. Motors. Résumé of published information, W. S. Leung, 10s 6d; Z/T130, Investigation on Stray Eddy-current Losses with Particular Reference to f.h.p. Induction Motors (Concluded), II. Dynamometer Core-Loss Tester. D. A. Jones and W. S. Leung. 10s 6d.

ASH FROM WILLINGTON

THE Minister of Housing and Local Government has dismissed an appeal by the CEGB against Derbyshire County Council's refusal to permit the Board to dispose of ash from Willington "B" power station in worked-out limestone quarries near Ticknall. Objectors maintained that the Ticknall site had considerable natural charm and was rich in fauna and flora. Permission has been granted, however, subject to conditions, for the disposal of the ash in gravel pits at Stanton-by-Bridge.

P-G Engineering Courses

POST-GRADUATE courses in electrical engineering available at Imperial College for the academic year of 1961-62 are outlined in a booklet available from the Registrar, Imperial College, Prince Consort Rd, S.W.7. Notable amongst them are lecture courses in electric traction, recently introduced as a special study at the college. Other electrical subjects in which specialised courses are available are electrical machines and power systems; automatic control systems and allied subjects; applied electron physics; and communications and electronics.

The mechanical engineering department of the college offers courses in nuclear power, including design and construction of nuclear reactors, associated power plant design, and reactor control and instrumentation.

Success in West German Market

WEST GERMANY is Britain's best customer as well as supplier in Europe and, for domestic electrical appliances, UK's share of the market has shown a moderate increase. In the first half of 1960 Britain supplied 27% of the Federal Republic's imports in this field, compared with 25% throughout 1959. This was before the first move in January towards a common external tariff among the Six, which leaves other members with an advantage of 3% to 5% for most appliances, but UK manufacturers have continued to consolidate and even improve their position since then. Paradoxically, UK exports to fellow members of the Seven remain static.

In a timely survey now that West Germany has revalued its currency by almost 5%, the BoT says first-class lines of distribution are essential to success in this buyers' market. Safety standards are important, and goods which do not bear the VDE mark of the Verein Deutscher Elektrotechniker or at least the certificate of some other recognised authority are seriously handicapped. As far as voltage is concerned, 220 V 50 cycles a.c. is virtually universal.

Pointing to various opportunities, the BoT says UK irons are widely admired for both design and quality, and lightweight and steam irons are gaining in popularity. UK manufacturers would have difficulty in competing in both space heaters and water heaters, though the currency revaluation may make a difference in relation to local manufacturers, but there is a demand for a really efficient portable air-conditioning unit combining heating, cooling and humidifying. Washing machines are doing particularly well, exports in the first ten months of 1960 nearing £¾ million, half as much again as in the corresponding period of the previous year. An influx of French semi-automatic washers has not affected sales of British automatic machines, and there is a growing preference for the revolving drum type. Competition from the large German makers of light fittings is particularly severe, but there are some prospects for low-priced fittings provided they have the VDE mark and are made to German specifications. Although there are some 15 dishwashing machines, including British, on the market, they have a potentially bright future. Electric blankets are not popular and market acceptance of grills is limited, but vacuum cleaner makers have turned the tide and are now sending more to Germany than are coming in the opposite direction.

Refrigerators are not covered by the survey, but here the position is that UK makers have more than held their own, exporting 879 domestic units to West Germany in January, while surplus stocks in this country have resulted in imports from Germany tailing off to a mere 82 units in the same month.

C.E.G.B. order boilers for Tilbury "B"

THE newly formed Foster Wheeler-John Brown Land Boilers consortium has received its first big boiler order. They are to make the four 350,000 kW boilers for Tilbury "B" power station. Each boiler will deliver 2,450 klb/hr of steam to the turbines, which will have stop-valve steam conditions of 2,300 lb/sq in. at 1,050°F with reheat to 1,050°F. As we reported last week, the CEGB have ordered the four 350 MW turbo-alternators from GEC, the first two scheduled to be commissioned in 1965 and the remaining two in the following year.

The CEGB also announce that Richardsons Westgarth (Hartlepool) Ltd. will make the steam condensers for this station. This order, approaching £3 million in value, is for four sets of condensing and feed-heating plant of an entirely new design developed by the Richardsons Westgarth Group. The Hartlepool subsidiary has also received a £100,000 order from Brown-Boveri, of Switzerland, for three 14,700 sq ft three-pass steam condensers.

Superlamp expands

SUPERLAMP LTD. have increased their number of electrical wholesale outlets in London and the Home Counties by the acquisition of Pooley and Austin Ltd. The move also introduces Superlamp to Oxford, where Pooley and Austin are well established.

Two additions to the Superlamp board are also announced; they are Sir George Bellew and Mr C. W. M. Phillips who was until recently managing director of Britannia Engineering, Luton, and before that was manager of the lighting department of AEI Lamp and Lighting.

NUCLEAR SUBMARINE PLANT ORDER

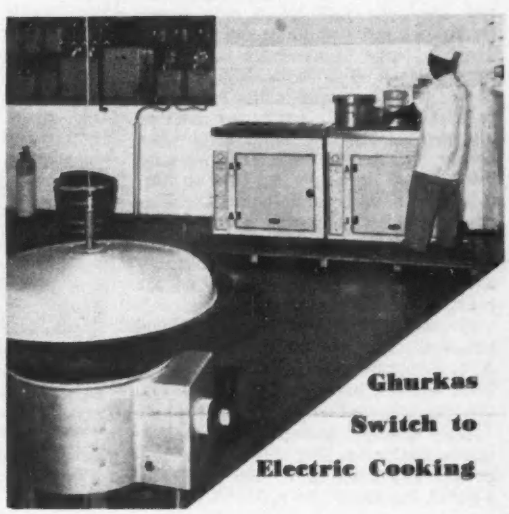
THE order for the design and manufacture of the electrical propulsion machines and control gear for the second British nuclear submarine has been placed with Laurence Scott and Electromotors Ltd. The submarine is being built by Vickers-Armstrongs (Shipbuilders) Ltd. We reported on 26 Jan. that English Electric Co. are to supply the propulsion steam turbines and condensers, while the nuclear reactor side is in the hands of Rolls Royce Ltd. The reactor will use enriched uranium and be moderated and cooled by pressurised water.

Coloured plug terminals?

A BY-LAW compelling electricity boards to inspect wiring in houses when they became vacant has been put forward by the local branch of the Electrical Association of Women to the Bridgwater Accident Prevention Committee. The latter were considering accident dangers from incorrect wiring of electrical equipment. It was decided to refer the matter to the Home Safety Federation along with another suggestion that in order to reduce accidents, plug terminals should be coloured to coincide with the colours of wires.

CUPAR SUBSTATION EXPANSION

TO meet the increasing load in the eastern part of Fife, the South of Scotland Electricity Board are to replace a 30 MVA transformer in Cupar grid substation by a 60 MVA unit. Part of the switchgear will be replaced by larger units and cable connections reinforced. Costing £80,000, the work is to be completed by the summer of 1962. The replaced equipment will be used elsewhere.



Ghurkas Switch to Electric Cooking

Electric chullahs are the latest thing in the South Seas. GEC have devised them for an all-electric kitchen at the Ghurka leave centre at Fort Auchery on the Penang coast, and they have proved so successful that the War Department is expected to specify them for any new installation where Asian cooking is predominant. The new kitchen has four chullahs, each with a 6 kW radiant element wound to fit the convex bottom of the accompanying kwali, or dish. In each kwali curry and rice for 60 people can be cooked at one time. A chullah, with kwali on top, is in the foreground of the picture

"The Spirit of Electricity"

The connection of this sculpture with the Spirit of Electricity is far from obvious, but it is abstract, when all is said and done, and this is the twentieth century. The artist, Geoffrey Clarke, took his inspiration from the filament of a light bulb. Our photograph shows a model only, and the real thing looks much better, especially in position on the blind concrete wall of Thorn's new building, towering above St. Martin's La, even unfinished and seen through the scaffolding. The coppery green colour blends aesthetically with the blank concrete.

There is one criterion by which this piece is unsurpassed: it is the longest sculpture in Great Britain. Cast in bronze, it is 80 ft tall and weighs six tons. Hoisting of the main part began at 6 a.m. on a recent Sunday. When assembly has been finished in about two weeks' time the sculpture will be floodlit at night

SPURIOUS COINS JAM METERS

EXTENSION of the stamp payment scheme, introduced by the South Wales Electricity Board for consumers in Cardiff last June, to consumers in other areas in south and mid-Wales has been advocated by the area consultative council. Under the system, a consumer buys 2s 6d worth of stamps at the showroom and these are fixed on a card, counting against his quarterly account. Extension of the scheme was advocated as a means of solving the problem of spurious coins which had jammed shilling-in-the-slot meters, causing friction between consumers and the Board.

Chairman of the Mid-Wales and Monmouthshire Committee, Mr E. H. Hickery, said the Board had reported the finding of hundreds of spurious coins in meters, including metal stampings, plastics counters and filed halfpennies. One consumer complained after being charged £2 to have her jammed meter cleared. But he considered that, if anything, £2 was too little and people who put these "coins" into meters must pay the cost. He also suggested that the possibility of removing shilling meters should be considered. The Consultative Council decided not to support representations from these jammed-meter consumers.

Derby's £2m Conversion

COST of changing over the electricity system in Derby to standard voltage would be somewhere in the region of £2 million, Mr N. Marsh, chairman of the East Midlands Electricity Board, told members of the Derby Electrical Society recently. But the Board were pushing ahead with changeover work and, during this year, nearly 7,000 consumers would be transferred to standard supply.

Do-it-yourself meter testing

ADVICE on checking electricity meters is offered in BSI Consumer Advisory Council's publication *Shoppers' Guide* in the March issue. "All you need to know," it is suggested, is the meter setting in revolutions/kWh. The advice then given—with no warning about permanently connected loads like clocks—is to run a 100 W lamp and note the time of one complete revolution of the meter disc. This approach is suggested as a simple way of checking suspected metering errors—"before contacting the local electricity board."

Council flay Snowdonia line opponents

COMBATING opposition from amenity interests, Merseyside and North Wales Electricity Consultative Council have given full support for the CEGB's plan to erect a supergrid line across the Snowdonia National Park. Councillor O. Thomas said objections to the proposed lines from Trawsfynydd and Anglesey were being raised by societies who wanted the lines placed underground; but it would cost about £1 million a mile to take a 400 kV line underground and for a 275 kV line, to be erected in the first instance, the cost would be £400,000 a mile; using pylons, the cost would be only £23,500 a mile. "None of us wants to see the countryside spoilt. It is an important economic asset, but we realise there must be development and that power must be brought through the countryside. The figures indicate that the CEGB have no other course open to them than to rely, in the main, on pylons. Putting the lines underground would mean an additional charge on all consumers. The price of electricity would go up unreasonably and could affect the economy of the country as a whole," he said.

Councillor W. L. Williams also pointed out that "one cannot eat landscapes. A certain amount of money comes in from tourism, but it cannot be said that the area lives on that."

Some attempt has been made to stimulate agitation against the Wylfa proposals, which are to be the subject of a public inquiry.

Subsequently, in a review of rural electrification progress, Councillor H. Evans reported that, judged on present pace it seemed possible that the current year would see the connection of a record number of farms in the Board's area. At the present rate of progress, over 83% of the properties in the rural area would be connected by the end of 1963.

ORGANISING FOR NUCLEAR EMERGENCY

WHEN accidents happen in a nuclear energy establishment, it is essential that a firm system of local control is established. Essential elements of such an organisation are set out in a publication of the UKAEA, published recently.

The recommended procedure recognises three types of "emergency." In increasing order of seriousness these are the building emergency; the site emergency; and the district emergency; the last applying where the effects extend significantly beyond the perimeter of the establishment concerned. The recommended procedure calls for designation of several senior officials as site emergency controllers, with one taking command when an emergency occurs.

Arrangements have to be made for notifying the police, local authorities and certain regional representatives of the central government.

The recommendations are published under UKAEA Code No. E.3.1.

The chairman and other board members of the London Electricity Board recently visited the Walthamstow works of Fuller Electric Ltd. to see some of the company's latest projects and developments, including two rectifier transformers for the Lydd terminal station of the cross-channel d.c. power link. Our picture above shows, left to right, Mr P. H. W. Everitt (Fuller director and works manager), Mr D. B. Irving (LEB chairman), Mr N. E. N. Plahn (Fuller managing director), Mr A. H. Frampton (joint managing director, Hawker Siddeley Industries), and Mr L. H. Welch (LEB chief engineer)

CUT PRICES AT SOUTHEND

A RETAIL "discount" store at Southend is selling electrical goods, among others, below the fixed prices set by manufacturers. For example, the Morphy-Richards "Popular" electric blanket is being sold at £3 1s 6d instead of £3 10s 10d and the same company's "Senior" iron at £2 4s instead of £2 8s 5d, according to *Shopper's Guide*, reviewing the venture opened a few months ago. Manufacturers' price-fixing policies are evaded by obtaining supplies through other channels.

The store, Supa-Save, is of a type which has mushroomed in the US. The manager, Mr P. Keddie, says that while some manufacturers protest against price cuts, he thinks they do so mainly to satisfy retailers and wholesalers and are most unlikely to sue. Additional "discount" stores are planned.

ORIGIN MARKS ON IMPORTED 'FRIDGES?

REFRIGERATOR manufacturers' requests that imported refrigerators should be compelled to bear an indication of origin will be considered by a standing committee of the BoT at a public inquiry at the BoT Office, Horse Guards Ave, S.W.1, at 10.30 a.m. on 4 May.

N.E. Power Planning

APART from the 1,200 MW station being built at Blyth, the CEGB has no plans for power stations in the North East of England. This was stated by Mr J. George, Parliamentary Secretary, Ministry of Power, in reply to a question from Mr N. Pentland, MP for Chester-le-Street. Mr George said that the first set at Blyth would come into operation in 1962 and the other sets by 1965.

Sayings OF THE WEEK

"Opponents of hydro-electricity on grounds of amenity might tell us what contribution they think a coalpit makes to the amenity of the area in which it is constructed." . . . MR T. FRASER, M.P. for Hamilton, in Commons debate.

"Telephone cables are being laid underground. Possibly in about 100 years the thickheads in the electricity board will do the same thing." . . . COUNCILLOR M. PILLING, of Crompton U.D.C. Surveyors Committee, discussing overhead line proposals.

"If these efforts [those of BEAMA for exporting] *had been made on the same scale and with the same intensity in other industries, this country would be in a very much stronger exporting position than it is today."* . . . LORD CITRINE, in House of Lords debate.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, March 28

	£ per ton	Weekly change £
COPPER, standard class A (settlement)	225½	−2½
" (3 months)	227	−1½
LEAD, refined pig, 99·97% purity (cash)	66½	−½
" (3 months)	68	−½
TIN, refined, min. 99·75% purity (settlement)	822	−½
(3 months)	822½	−½
ALUMINIUM, ingots 99-99·5%	186	—
" wire bars (4×4×54")	193½	—
BRASS Strip 63/37	201½	—
SILVER (Troy oz)	79⅝d	—

	£ per ton	Weekly change £
ZINC, virgin, min. 98% purity (cash)	82½	−1½
" (3 months)	82½	−½
RUBBER, per lb.		
No. 1, RSS, spot	25½d	−⅛d
c.i.f. basis, ports, June	25d	−⅛d
ARMOURING:		
Galv. Steel Wire (0·104 in.)	66½	—
Mild Steel Tape (0·04 in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	69	—
AMERICAN PRICES:		
Copper, electrolytic (per lb)	29c	—
Lead, (New York)	11c	—

* *Tape Price, now an average, includes varnishing*

Connection Programme in South West

PLANS to connect up at least 10,000 more rural consumers, including over 3,000 farms, in the West Country during the next two years were revealed to the South Western Electricity Consultative Council at its meeting last Friday. During the next 12 months the South Western Electricity Board plan to take electricity supplies to 5,500 rural properties, including over 1,600 farms. In Somerset 1,500 cottages and other premises (including 250 farms) will get supplies; in Devon over 2,500 premises (800 farms) will be connected; and in Cornwall 1,400 properties (550 farms) will benefit. For the following year, in a tentative minimum programme, it is planned to connect nearly 5,000 premises, including over 1,400 farms. The Board warn, however, that despite this large expenditure on development, and the high rate of rural electrification achieved, by March, 1963, there will still be 7,000 farms and several thousand more rural properties still awaiting supplies. Completion of the task will take many years.

Provided the capital becomes available, plans have been made to have 85% of all farms connected by the end of 1964, but this will leave about 4,500 farms and less than 10,000 other rural properties to be supplied.

Turning the heat on dog tracks

UNDER-TURF heating of dog tracks apparently works; for the Greyhound Racing Association, which has already tried out the idea at Edinburgh, has placed an order with GEC to provide similar installations at Harringay and White City in London and Belle Vue at Manchester. Win or lose, frosty ground is too hard for the greyhounds' pads. GEC will lay nearly 30 miles of mains voltage soil-warming cable beneath the three tracks. An immediate start will be made at Harringay and Belle Vue, and the White City installation will be put in next year.

No office regulations yet

NO regulations will be made under the Offices Act, 1960, when it comes into force on 1 Jan. next. This was stated in the House of Commons last week by the Minister of Labour, Mr J. Hare. He said that before the 1960 Act came into operation, a Government Bill to deal with health, safety and welfare in shops and offices would be introduced. The Government's view was that there was no point in making regulations under the Offices Act (a private member's measure) when comprehensive legislation was on its way.

It is likely that the promised Government Bill will deal with questions such as lighting, heating and ventilation of offices, and with other matters such as fire precautions.

News in Brief

A fire destroyed 54 trams at the Dalmarnock depot of Glasgow Corporation last week.

The Electrical Sign Manufacturers' Association has agreed to join a British section of the European Federation of Outdoor Advertising.

A new service centre has been opened at Guisborough by the North Eastern Electricity Board.

Michigan (GB) Ltd.'s Model 280 tractor-dozer handled an average of 1,346 tons of coal an hour over an average distance of 50 ft during trials at Brighton "B" power station recently. The 262 h.p. tractor was fitted with a special coal blade 16 ft wide and 5 ft high.

A training school for instrument engineers has been set up in Bombay by Honeywell Controls in conjunction with their Indian associates, Blue Star Engineering Co.

In the finals of the British Electricity Ambulance Centre National First Aid competitions in London last week, the men's competition was won by a team from Chester (Merseyside and North Wales area) and the women's competition by Manchester (North Western area).

Laying of the trans-Atlantic section of the Commonwealth round-the-world telephone cable will begin from Oban, Scotland, within a few days.

OVERSEAS NEWS

from our correspondents abroad

CANADA

BC Power Maintains Growth

Although economic conditions deteriorated during 1960, the annual report for British Columbia Power Corporation records a 6·6% increase in gross revenue to $103,297,019. Earnings for the year fell slightly to $11,197,249, or $2·37 per share, compared with $2·48 per share in 1959. Electricity revenue rose 6% and demand was 7% greater at 3,527 million kWh. Revenue from sales of gas rose by 25·3% during the year. To this increase in sales is attributed the relatively small increase in electricity consumption by residential consumers of 2·1%. In the past five years the number of consumers using gas for space heating has increased by a factor of no less than 35. In 1960 the 492 MW Bridge River hydro-electric scheme was completed and work continued on the Burrard thermal station, which is to have an eventual capacity of 900 MW. The total generating capacity of the Corporation at the end of 1960 was 1,093 MW. In April the BC Engineering Co. ceased operations and its duties were taken over by International Power and Engineering, in which the Corporation and Balfour Beatty each have a 50% interest. The purchase of the Hat Creek coal deposit was undertaken as a long term policy and is estimated to be capable of supporting a thermal plant of 2,000 MW capacity.

Slight Profit Fall for Manitoba

The report of the Manitoba Power Commission for the year ended 31 March, 1960, shows a decline in profits over the previous year of 2% to $917,856. Net operating revenue rose to just over $21 million and income to $21·5 million. Generation and purchase of electricity totalled 1,677 million kWh, nearly 11% higher than in the previous year. During the year under review the Commission erected three substations in Greater Winnipeg and discontinued the direct sale of electrical appliances.

Price-cutting Condemned by Makers

Threats by a few manufacturers to cut off supplies of their goods have been addressed to some retailers and discount houses if they sell goods without profit. This practice, rife in Toronto as one result of the swing to a consumers' market, is being used by some shops to attract potential customers. Some manufacturers, but not all, condemn it because it may put reliable dealers out of business and they contend they are backed by the amendment to the law last August which gives them the right to hold back supplies of goods from dealers selling at a loss. On the other hand, one discount store says that the publication of a pricing guide by at least two manufacturers is tantamount to price fixing, which is illegal.

Fraser Valley Expansion

Expansion of electric and gas facilities in the Fraser Valley by BC Electric are estimated this year to cost $2,280,000. The electrical programme, totalling $1¼ million, includes $603,000 for transmission lines, $489,000 for a new 40 MVA substation in Whalley district and $157,000 for work on other substations. A further $200,000 will be used to raise the voltage of 19 existing lines.

Kitimat Shut-down Planned

An abnormal increase in hydraulic losses in a tunnel supplying the Kitimat hydro-electric plant of Alcan is thought to be caused by a rock fall. A temporary shut-down for examination has been arranged for June next. Estimated cost of repairs to the tunnel is $1 million.

YUGOSLAVIA

US Win Generator Contract

A contract for hydro-electric generators for two new power stations near Dubrovnik has been awarded to International General Electric. The generators will be installed in the Grancarevo dam about ten miles from the Adriatic coast. IGE claim to have won the contract in the face of competition from 16 firms and with no financial limitations.

U.S.S.R.

Nuclear Station Takes Shape

The first turbine of the Novo-Voronezh nuclear station is reported to be under assembly. This station, designed for 420 MW output, will have a water-moderated reactor. The first section of three 70 MW sets is scheduled for operation in 1962.

Plans for Large Hydro Project

A proposal has been put forward to form a 6,000 sq mile reservoir at the confluence of three rivers in the USSR, the Pechora, Vychegda and Upper Kama. Estimates suggest that the scheme could generate as much electricity as the Lenin power dam on the Volga. Construction is expected to take about seven years.

Finns to Build Hydro Station

A contract for building a 225 MW hydro-electric power station at Tulemajoki in northern USSR has been awarded to the Finnish State-owned company, Imatran Voilma. The power station will be on the River Tuloma, about 125 miles from the nearest Finnish village of Inari. The main generators will be supplied by the Soviet Union, but it is believed that the value of the contract to Finland is about £21 million.

RHODESIA & NYASALAND

Another Set at Kariba

The fourth of six generators was recently brought into service at Kariba. It will be recalled that these units are rated 100 MW and were constructed by AEI. The level of the lake, which has been rising at about 2 in. per day, is now 268 ft at the dam wall. With Kariba approaching its full power output, interest centres on the possibility of a £6 million investment project which would be a large user of Kariba power. Talks are now being held between the Minister of Commerce and Industry and the project sponsors. The Minister also referred to the possibility of an £18 million oil refinery and two motor assembly plants being established.

PAKISTAN

Mangla Dam Start This Year

Construction work on the Mangla dam is expected to begin in December this year. This was stated recently by Mr Shah Nawaz Khan, the superintendent engineer. He added that tenders for the construction work would be invited from eight overseas countries, including Great Britain, probably in June. The Mangla is a multi-purpose project intended, primarily, to conserve flood waters of the River Jhelum, but also to generate hydro-electric power. It is hoped that the dam will be completed in 1968 with the three generators in service by 1969. The preliminary survey work is already well in hand. Construction will begin after the Pakistan Government and World Bank have approved the tenders.

Good Progress on Multan Line

About five-sixths of the 60-mile, 132 kV line linking Multan to the Bahawalpur power station has been completed and the remaining section is scheduled for completion in the next two months. Survey work is proceeding on a 15-mile 132 kV line to link Chichawatni to Kamalia and work will begin shortly.

Nuclear Power Possible for Pakistan

Because of the high cost of conventional fuels and the remoteness of hydro power sources the Pakistan Atomic Energy Commission feel that nuclear fuel has applications for some areas of the country in the near future. This opinion was expressed by the authority's

chairman, Dr Usmani, recently when he added that active studies of the feasibility of using nuclear fuel in areas where conventional fuel costs were high was being actively studied. A centre to train scientists had been established at Lahore and another is under construction at Dacca.

INDIA

Third Plan Increase Likely

An increase in the Third Plan allocation by Rs100 crore is anticipated, as reported in ELECTRICAL TIMES for 16 March, 1961. As a result of the acute power shortages which developed in the Durgapur Valley area under the Second Plan, the Planning Commission are following the Power Ministry's suggestion that the target should be about 14,000 MW. Raising the target from the present 11,800 MW to the 13,400 MW now considered necessary will cost an additional Rs100 crore. Practically all foreign loans have been drawn upon for new power stations and about 75% of the Third Plan projects have been provided for. A World Bank team is to visit the country shortly to examine outstanding requests for financial assistance. Power shortage in the eastern region is being tackled and, under the Third Plan, 1,700 MW of plant are to be added. This includes 875 MW in DVC, 500 MW in West Bengal and 350 MW in Bihar. The Third Plan provides for a 125 MW unit at Durgapur and two similar units at Chandrapura. In West Bengal, four 75 MW stations are planned at Bandel, and in Bihar the Pathratu station is to have five 50 MW sets. Recent poor river flow in the DVC area and some commissioning difficulties are reported to have caused the power shortage in the eastern industrial belt. The position has recently improved and is expected to be normal in the next few months.

Higher Cost for Bhakra

A further increase in the cost of the Bhakra-Nangal project was predicted recently. Owing to additional drilling and grouting necessitated by the conditions of the dam foundations, it seems likely that Rs5 crore will be added to the cost, giving a total of Rs175 crore.

Russian Interest in Pathratu

The Deputy Minister for Irrigation and Power said recently that agreement had been reached with the Soviet Government to establish a thermal power plant at Pathratu, near Ranchi, in Bihar. This is, presumably, the station referred to recently as being extended in rating from an original planned output of 100 MW, to 250 MW.

Supergrid Unlikely Yet

It seems unlikely that the all-India supergrid will be constructed under the third Five-year Plan. However, by the end of the Third Plan, or the beginning of the Fourth, the southern grid will be in service, linking the States of Andhra Pradesh, Kerala, Madras and Mysore. In answer to a question in Lok Sabha recently, the Deputy Minister said he could not say if the southern states grid would be self-sufficient in view of the rapid rise in demand for electricity.

Indo-Japanese Cable Plant

Production is expected to begin in mid-1962 at the Indo-Japanese cable factory at Tripunithura, about six miles from Ernakulam. The Kerala Government is subscribing Rs10 lakh to the share capital of the company and the Japanese interests are providing technical collaboration. Output of the factory will initially be 36 million core-yd of cables and insulated wires per annum.

MALAYA

Cameron Highland's Turbines

An order valued at £50,000 has been placed with Gilbert, Gilkes and Gordon for two water turbines. The turbines are rated at 4,500 h.p. and they will form part of the Cameron Highlands hydro-electric scheme in Malaya.

CEYLON

Power Shortage in 1963

Almost a certainty is a power shortage in 1963-64, according to the annual report of the Ceylon Department of Government Electrical Undertakings. The shortage will last until the 50 MW station under stage 2B of the hydro scheme is commissioned. During the past year, a further seven villages were electrified by the undertakings. Total revenue for the year was Rs31,447,375, working expenditure was Rs11,633,312 and the annuity and interests were Rs12,089,966. The general manager is reported to have attributed the possible shortage to delay in completion of the Laxapana scheme, of which stage 2B is a part. Power failures already occur in Colombo and anxiety is expressed in some quarters that they may become progressively worse unless immediate action is taken.

JAPAN

Mihoro Power Station

The Mihoro power station which came into partial operation in January will have an ultimate output of 215 MW. Commissioning was pressed forward from the original date in June because of soaring demand.

Appliance Sales Rise

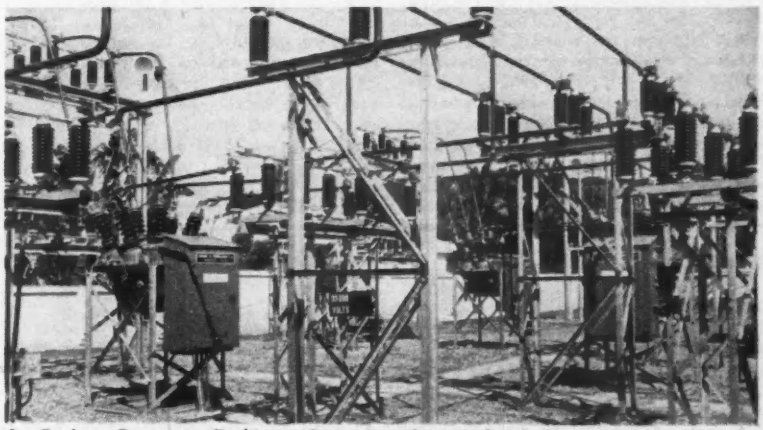
Electrical appliances sold in Japan last year were worth between £370 million and £380 million. This is nearly 30% more than in 1959. Sales of refrigerators were said to have risen 40%, while television set sales rose by 20%. Manufacturers estimate that for the current year, sales will exceed £400 million with refrigerator sales up a further 50% and room cooler sales up 100%.

Loan for Thermal Station

A loan equivalent to $12 million has been made by the World Bank to assist financing of a 156 MW thermal power station at Kokura in northern Kyushu. The station will be designed for future extension to 532 MW at a total cost of nearly $28 million. Japanese manufacturers are supplying all major plant and the station is expected to be completed in December this year.

Boiling-water Reactor

Work begins in April on a direct-cycle boiling-water reactor at Tokai Mura, about 50 miles from Tokyo. The 12·5 MW plant will be built by General Electric of Japan and is scheduled for completion in 1963.



In Ceylon, Crompton Parkinson have recently completed three substations in the environs of Colombo as part of the Government's programme for large scale development of the island's distribution system. Distribution throughout the municipal area of Colombo will eventually be by three ring mains energised through the three 33 kV substations. The complete construction and erection was undertaken by the company and includes the provision of six 12·5 MVA and four 500 kVA transformers, 19 33 kV o.c.b's, low voltage switchgear and control panels. Interconnections are by paper insulated h.v. cables and plastics colour-coded l.v. cables

Company Activities

NOT a small measure of the market's recent strength must derive from anticipation of the share-buying that will occur when the Trustees Bill—which will allow trustees to invest up to half their funds in equities—becomes law within the next month or two. This is now buttressed by the announcement that a number of bodies including the County Councils' Association, the Urban and the Rural District Councils' Associations, the Association of Superannuation Committees and several other such bodies intend to form a Local Authorities' Mutual Investment Trust. It has been estimated that about £10 million a year will flow into the new trust and although that may look small against the £500 million already invested by local authorities in England and Wales, it will not only create another demand pull upon share prices but sets firmly the seal of complete respectability upon the industrial Ordinary share. The formation of "LAMIT," as the new trust is to be named, is bound to generate a powerful "bull" pyschology which will tend to be sustained by the *de facto* share-buying it will induce. Any investor in two minds about whether to enter the market at this stage would be well advised to take "the plunge" before he or she misses the proverbial boat.

In fact, the share slide by the three leaders in the electrical share market last week might provide a useful opportunity. On the profits warning from GEC the £1 Ordinary shares dropped steadily back from 38s 6d to 35s 3d after their recent "high" of 39s 6d. At this lower level the dividend yield is now back up to 5·7%. Although profits for 1960-61 are now expected to be "significantly lower" the chairman proposes to repeat the total dividend for the year at 10%. Radio and Allied Holdings, for which GEC is takeover bidding, dropped in sympathy from 38s 9d to 35s 4½d. For 1961-62 GEC's hope is for increased profits as a result of its reorganisation which includes the integration of Radio and Allied.

GEC's temporary gloom, however, was enough to knock the £1 Ordinary shares of AEI from 47s 9d to 44s 6d compared with their 1961 "high" of 48s 6d and at which lower level they now yield 6·7%. English Electric, now yielding 5·3%, were clipped back from 40s 3d to 37s 9d after their recent 1961 "high" of 40s 6d.

Bright spots, nevertheless, were the rule in the electrical market rather than the exception. Bulpitts saw their 5s Ordinary shares come up to a rapid boil, up from 17s 3d to 26s 6d at one time on takeover talk and, even after official denials, still left them 6s 3d higher at 23s 6d. Who the supposed bidder might be remains something of a mystery although both Tube Investments and British Electronic Industries—the Pye-E. K. Cole merger—have been mentioned.

Dimplex stepped up their interim payment from the equivalent of 8½% to 15% and this was accompanied by a statement on eight months' profits, sufficiently cheering to put the 5s Ordinary shares 1s 3d higher to 71s 3d although subsequent profit-taking lowered them to 68s 6d. There was also encouraging half-time news on profits from Harper Engineering and Electronics which lifted the 2s 6d Ordinary shares from 6s 3d to 7s 3d. With the shares now yielding 11%, with a new chairman, and the shares back from their 13s 1960-61 "high," a useful capital profit is still a distinct possibility here in 1961.

Wolf Electric Tools (Holdings) pleased with a rise in before-tax profits from £277,300 in 1959 to £308,200 last year and an increase in the dividend from 12½% to 13¼%. Up spun the 5s Ordinary shares from 16s 3d to 17s 1½d before easing back to 16s 10½d.

Bulpitts, Dimplex, Wolf: all three might be classified as "second division" names as opposed to the top division "Blue Chips." In the time ahead, however, when such bodies as "LAMIT" *et al* have signed up most of the available market leaders it is such second string names as these that will increasingly be sought after by the investing public.—*From our City Correspondent.*

Dimplex Ltd.

With news of raising the interim dividend from the equivalent of 8½% to 15% (partially to bring the interim more into line with the final) Mr E. J. Wade, chairman, reports that despite an exceptionally mild winter, turnover for the first eight months to the end of February last shows a satisfactory increase when compared with the same period of the previous year. The new factory has been occupied and, during the past few months, an additional freehold site adjacent to the existing works at Millbrook, Southampton, has been purchased. It is planned to erect a new factory on the site.

Dowty Group

The offer by this concern for the issued capital of Boulton Paul Aircraft (also makers of electronic equipment) has been accepted in respect of over 50% of the stock, it was stated last week. Mr J. D. North, Boulton Paul chairman, considers it is misleading to compare the 30% dividend BP holders will receive for 1959-60 with the expected income if they accept the offer. He believes that if the company continues to operate on its own the gross dividend in the foreseeable future is unlikely to exceed 20% and in a year or two might well be less. The Dowty board consider that company's difficulties transitory and that the next 12 months should see at least a recovery to former profit levels.

Franco Signs Ltd.

After taxation at £58,766 (*£60,310*), consolidated net profit for the year to 30 Sept. last is £79,042 (*£84,173*), the decreases being attributed to a labour dispute which resulted in loss of production to a varying degree for some six weeks. Dividend is again 16%.

Harper Engineering and Electronics

Sales in the main engineering sections for the six months to 31 Dec. last are higher than in the corresponding period of last year and profits are well maintained, the directors state. Indications for the second half of the year are encouraging, the order books, in the main, being up to full productive capacity. With margins continuing profitable there are hopes that the full results for the whole year will be up on a year ago. Development of new products continues and the group's financial position is being strengthened by action initiated in recent months. Negotiations directed to improving the capital structure are reaching an advanced stage.

Skefko Ball Bearing Co. Ltd.

Profit balance for 1960 is £1,004,007, against £829,749 for the previous year, and a final dividend of 9½% makes the total distribution 12%, compared with the equivalent of 10½%.

Superheater Co. Ltd.

Group trading balance for 1960 dropped to £576,464 from the previous year's figure of £808,504, but a final dividend of 17½% maintains the total distribution at 25%. After the taxation charge at £287,371 (*£391,895*) net profit is £326,650 (*£439,802*). Shareholders were warned by the board last September that owing to smaller output and narrower profit margins, earnings in the first eight months were considerably lower.

Telefusion Ltd.

A rights issue of 345,000 Ordinary 5s shares at a price of 27s 6d each is being made on a one-for-six basis by this TV and radio relay concern. The proceeds, some £474,000, will be used to reduce the bank overdraft which is standing at £670,000. The directors anticipate that group profits, before tax, will be substantially higher than last year, but it is emphasised that the tax charge last time was exceptionally low. They expect to recommend a 22½% final dividend on the increased capital, following the 8½% interim.

Telephone and General Trust

Although the group net profit for 1960, after taxation, is down slightly to £472,223, the dividend is raised from the equivalent of 13·64% to 16%, with a final of 11% on the larger capital. For the previous year, net profit was £501,345. Taxation charged is £232,559 (*£224,494*).

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

30 March—Cardiff C.C. Rewiring of up to 1,000 houses.—See 23 March issue.

30 March—Down C.C. (c) Mechanical and electrical installations in Gilnahirk Primary School extensions (eight classrooms). Applications to Director of Education, 7 Brunswick St, Belfast 2, by 4 p.m. on above date.

30 March—Newcastle upon Tyne T.C. Electrical installations, Kenton North estate.—See 9 March issue.

30 March—Stockport T.C. Electrical installation 62 houses, Canal Bridge Farm estate.—See 9 March issue.

31 March—Loanhead T.C. Electrical work in the modernisation of eight houses, Lamb's Pl and Mayburn Terr. Applications to architects: G. L. Walls and Partners, 14 Gt. King St, Edinburgh 3, by above date.

1 April—Bowdon U.D.C. Supply and erection of 105 Group "B" concrete columns with post-top lanterns. Surveyor, Council Offices, Richmond Rd.

1 April—Campbeltown. (ii) Provision and installation of pumps, boilers, steam heating, electrical generating and distribution systems in P.O.L. storage depot, NATO Naval Base Installation.—See 23 March issue.

4 April—Devizes B.C. Electrical installations 1-12 Deramore Row.—See 9 March issue.

4 April—Kidkcudbright C.C. Electrical work in alterations and major additions to Secondary School, Gatehouse. Applications to County Architect, A. Hunter, County Offices, Kirkcudbright, by above date.

5 April—Aldridge U.D.C. (a) Erection: three Group "A" columns, 57 Group "B" columns, 15 aluminium columns, and supply/erection of three 250 W m.v., 30 60 W sodium lanterns/gear, 27 100 W tungsten lamps/lanterns, and 15 m.v. 80 W lanterns/gear; (b) erection: 57 Group "B" columns, supply/erection of 20 100 W tungsten lamps/lanterns, and 37 60 W sodium lanterns/gear.—See 9 March issue.

5 April—Darvel B.C. Electrical work in 12 houses as three-storey flats at Ranoldcoup Rd. Applications to architect: A. Dunlop, 110 King St, Kilmarnock, by above date.

5 April—Durham C.C. Electrical installations: (d) Seaham Harbour Grammar Technical School: (e) Training Centre, Aykley Heads: (f) Staindrop new modern school; Crookhill County School and Seaham Harbour R.C. (Aided) Modern School. Applications to County Architect, South St, Durham by above date.

5 April—Harrogate B.C. Supply of: (a) ten 140 W sodium lanterns/gear; (b) 65 140 W sodium lanterns/gear; (c) six and (d) seven 3 x 80 W fluorescent lantern/gear; (e) 300 tungsten lanterns; (f) 130 time switch boxes; (g) 130 swan-neck brackets; (h) 300 synchronous time switches; (i) 65 control gear boxes.—See 23 March issue.

5 April—Llantrisant and Llantwit Fardre R.D.C. Rewiring of 224 houses, on fixed-price basis, at Tynbryn.—See 23 March issue.

5 April—Manchester C.C. Supply and installation of 600 yd 415 V 4-core 0·3 sq in. p.i.l.c.s.w.a. and s. cable at Davyhulme.—Advertised in 16 March issue.

5 April—Peterborough J.E.B. Electrical installation, by contractors on N.I.C.E.I.C. roll, in 42,500 sq ft Peterborough Technical College extensions.—See 23 March issue.

6 April—Brighouse B.C. Supply: mercury lamps.—See 16 March issue.

6 April—Cardiff C.C. Electrical installation in F.5 one-bedroom flats.—See 23 March issue.

6 April—N. Ireland H.A. (2) Electrical work in two patients' villas, Muckamore Hse. Applications to Secretary, 27 Adelaide St, Belfast 2, by above date.

7 April.—Batley B.C. Supplying of street lighting equipment including: columns/lanterns, gear and sodium lamps. Borough Engineer and Surveyor, Hanover Sq.

7 April—Bilston B.C. 280 60 W sodium Group "B" lamps on concrete columns.—See 2 March issue.

7 April—Southport C.B.C. (1) Electrical equipment for home for the aged kitchen, at Ainsdale.—See 23 March issue.

8 April—Bournemouth C.B.C. Supply of 260 Group "A" and 2,800 Group "B" lighting units including 1,200 special brackets and spigot boxes for conversion of gas columns. Borough Engineer, Town Hall.

8 April—Folkestone B.C. (1a) Installation of water heaters/wash hand basins and power installations in house modernisation programme.—See 23 March issue.

10 April—Barrow-in-Furness C.B.C. Supply and erection of two 8,000 g.p.m. main pumps and one sump pump of 800 g.p.m., together with motors and gear for Sandgate Pumping Station.—See 23 March issue.

10 April—Basildon U.D.C. (1) Supply and erection of 99 Class "B" tungsten lamps on concrete columns and (2) supply of 225 pole bracket lamps. Engineer and Surveyor, 88 Town Sq.

10 April—Dartford B.C. Rewiring in modernisation, 71 houses, Lowfield St estate.—See 16 March issue.

10 April—Manchester C.C. Electrical installation in aged persons' home, Goodier St, Harpurhey.—See 23 March issue.

10 April—Manchester C.C. Electrical installation in Whitebrook School for the Deaf, Fallowfield. City Architect, P.O. Box 488, Town Hall.

10 April—N. Ireland. Supply: household appliances and suction cleaners to Nurses' Home, Erne Hospital.—See 9 March issue.

10 April—N. Ireland H.A. (3) Electrical work in two patients' villas, Muckamore Abbey, Co. Antrim. Applications to Secretary, 27 Adelaide St, Belfast, by above date.

10 April—Rowley Regis B.C. Supply of electrician's requisites and batteries for year. Town Clerk: G. C. Cookson, Municipal Bldgs, Old Hill, Staffs.

11 April—Dunbartonshire C.C. Street lighting maintenance for year. Details from County Sanitary Inspector: N. Macdonald, 124 Bridge St, Alexandria.

11 April—East Riding C.C. Electrical services installation in Howden County Secondary School. Details from County Architect, County Hall, Beverley.

12 April—Shipley U.D.C. Electrical installation renewal in Manor La Baths. Surveyor, Town Hall. Deposit £2 2s.

12 April—Stokesley R.D.C. 250 g.p.m. sewage pumping plant (Contract 2) and (Contract 3) electrically operated air compressors and ejector plant.—See 23 March issue.

12 April—Tyne Improvement Commission. Supply of rail-mounted, 30 ft jib, ten-ton crane.—See 23 March issue.

12 April—Ulster Transport Authority. Supply of (List 15) lamps; (16) cables and flexibles; and (39) torches, cycle lamps and batteries. Stores Superintendent, Duncrue St, Belfast 3. Fee 1s each form.

14 April—Letchworth U.D.C. Removal/resiting and conversion of 93 steel columns and erection of 41 Group "A"/104 Group "B" concrete columns and 16 steel Group "B" columns, together with the installation of lanterns/gear. Engineer and Surveyor: E. L. Johnson, Town Hall. Deposit £2 2s.

14 April—Morley B.C. 27 140 W sodium units on 25 ft concrete columns.—Advertised 16 March issue.

14 April—Pocklington R.D.C. Supply and erection of duplicate 85 g.p.m. sewage pumps and an 80 g.p.m. sludge pump, together with motors, starters and accessories. Details from consulting engineers: John H. Haiste and Partners, Belmont Hse, 20 Wood La, Headingley, Leeds 6. Deposit £3 3s, made payable to R.D.C.

15 April—Chapel-en-le-Frith R.D.C. Electrical installation in eight houses. Engineer and Surveyor, Hayfield Rd, Chapel-en-le-Frith, via Stockport.

15 April—Coleraine R.D.C. Electrical installations in 22 dwellings. Details from consulting engineers: W. and M. Given, 1 Waterside, Coleraine. Deposit £2 2s.

17 April—E.B. for N. Ireland. One steam- and one motor-driven feed pump for Coolkeeragh.—See 2 March issue.

17 April—Flintshire C.C. Provision and erection of: distribution; pillar; eight 30 ft columns; 200 W sodium lanterns; four

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 114 queries answered this week

"Acrosign" directional signs—makers of? G. and H.—Acro Marketing Ltd., 10 Emerald St, W.C.1.

"Gothic" switches—address for? T.B.—Gothic Electrical Supplies Ltd., Gothic Hse, Henrietta St, Birmingham 19.

"Fisher" water heaters—address for spares? S.E.E.B.—Auto Units Ltd., 308 Long La, N.2.

"Bustler" vacuum cleaners—address for spares? W.H.P.—H. Miller and Co. Ltd., Aston Brook St, Birmingham 6.

"Portway" commercial baking ovens—makers of? S.E.E.B.—C. Portway and Son Ltd., Halstead, Essex.

"Delanco" insulating materials—makers of? T.E.—Anglo-American Vulcanised Fibre Co. Ltd., Cayton Wks, Bath St, E.C.1.

Electric firelighters—makers of? P.R.—**Poker type**—Lupus Electrical Products Ltd., Lupus Wks, Oxford Rd, Altrincham, Ches.: Kindler Electric Co. Ltd., The Greys, High St, Harlington, Middx.; Hockley Electric Co., 56 Gt. Hampton St, Birmingham 18. **Hot air, blower type**—The General Electric Co. Ltd., Magnet Hse, Kingsway, W.C.2; Carron Co., Carron, Falkirk, Scotland; Simplex Electric Co. Ltd., Creda Wks, Blythe Bridge, Stoke-on-Trent, Staffs.

ANSWER WANTED

"Megmet" insulation tester—makers of? E.E.W.—

fluorescent units for advance direction signs; and wiring, including 12 "Keep Left" bollards.—Advertised 23 March issue.

17 April—Newcastle upon Tyne C.C. Supply and erection of one 40-ton, two ten-ton and two six-ton travelling cranes for new quay. City Engineer, Town Hall.

17 April—Port Talbot B.C. Supply, erection and cabling of 36 35 ft steel columns with double outreach; ten 35 ft columns with single outreach; 45 200 W sodium lanterns; 18 "Keep Left" bollards; 2,300 yd cable, traffic signs, etc., for Talbot By-Pass lighting.—See 23 March issue.

17 April—West Riding C.C. (a) Provision of motorway signs and fixing/wiring of sign lighting; (b) provision of 80 W fluorescent floodlighting lanterns, also 8 W and twin 6 W cantilever lighting units. Clerk, B. Kenyon, Room 87, County Hall, Wakefield.

18 April—Sunderland C.B.C. Electrical installations in 305 dwellings, Town End Farm estate. Borough Architect, Grange Hse, Stockton Rd.—Advertised in this issue.

18 April—West Riding C.C. Electrical installation in Gomersall C.E. school.—See 23 March issue.

19 April—Athy U.D.C. Duplicate 14,000 g.p.h. water pumps.—See 16 March issue.

20 April—Wallasey C.B.C. Electrical installations in 46 maisonnettes, Mersey St area. Borough Architect, Town Hall.—Advertised in this issue.

21 April—Bedlingtonshire U.D.C. Supply: electrical goods, cookers and boilers.—See 16 March issue.

21 April—Larne B.C. Electrical installation in Municipal Offices, Victoria Rd. Council Offices, Gardenmore Hse. Deposit £3 3s.

24 April—Rhondda B.C. Supply and erection of Group "A" sodium lighting on prestressed spun concrete and steel columns along 10¼ miles of classified roads. Details from Borough Engineer and Surveyor: E. T. T. Rees, Municipal Offices, Pentre, Rhondda, on receipt of s.a.e.—Advertised in this issue.

29 April—Staffordshire C.C. Supply of (a) demonstration equipment for electrical laboratory; (b) chemical laboratory major equipment; and (c) X-ray apparatus for nucleonic block.—Advertised 23 March issue.

29 April—Staffordshire C.C. Supply of batteries and battery chargers. Director of Education (Supplies), County Education Offices, Earl St, Stafford.—Advertised in this issue.

1 May—Ipswich C.B.C. Electrical installation in St. Mathew's Baths. Borough Engineer and Surveyor, 19 Tower St. Deposit £3 3s.—Advertised in this issue.

2 May—Newry No. 2 R.D.C. Supply and installation of duplicate 25 g.p.m. at 335 ft head pumps for Tullymacreeve Booster Station. Details from consulting engineers: N. O'Dwyer, Son and Partners, 6 Trevor Hill, Newry, Co. Down. Deposit £5 5s.

15 May—Newcastle upon Tyne C.C. Electrical installation. baths and laundry, Montagu estate.—See 16 March issue.

No date stated—Bristol C.C. Electrical work in boiler and heating installation, College of Commerce.—See 23 March issue.

No date stated—Sheffield C.C. Waterworks. Supply and installation of 11/3·3 kV and 3·3 kV/415 V transformers, 3·3 kV air break switches, 3·3 kV contactor starters, etc., for Yorks Derwent Scheme. Details from General Manager and Engineer, Waterworks Office, Castle Market Bldg.—Advertised in this issue.

CONTRACTS PLACED

C.E.G.B. Contracts placed during the past month amounting to £11,031,000 include: Thorpe Marsh power station: instruments and control equipment, Electroflo Meters Co. Ltd.; main circulating water pumps and motors No. 2 set, Drysdale and Co. Ltd.; No. 2 condensing and feed water heating plant, Hick, Hargreaves and Co. Ltd. Blyth "B" power station: ash handling plant, Holdan Engineers (London) Ltd. West Burton power station: starting and stand-by boiler feed pumps and motors associated with turbo-generator sets 1, 2, 3 and 4, Mather and Platt Ltd. Rugeley power station: foundations and superstructure for No. 5 unit, J. L. Kier and Co. Ltd. West Thurrock power station: coal unloading cranes associated with No. 3 and 4 units, Stothert and Pitt Ltd.; two 300 MW turbo-generators No. 3 and 4, feed heating and evaporating plant and associated feed pumps, Associated Electrical Industries Ltd. Richborough power station: 415 V switchgear, contractor control gear and accessories for units 1, 2 and 3, The English Electric Co. Ltd. Bankside power station: low pressure pipework, valves and auxiliary pumps, Aiton and Co. Ltd.; 66 kV switchgear, Associated Electrical Industries Ltd. Deptford East power station: grit arresting plant, E. Green and Co. Bolton substation: one 45 MVA transformer and earthing transformer, Fuller Electric Ltd. Carrington substation: one 180 MVA, 275/132 kV transformer, Associated Electrical Industries Ltd. Harker-Connah's Quay: 275 kV switchgear modifications, The English Electric Co. Ltd. Whitson substation: four 75 MVA 275/33 kV transformers, Fuller Electric Ltd. Elland substation: four 180 MVA, 275/132 kV transformers, C. A. Parsons and Co. Ltd.

C.E.G.B. (Eastern, London and S.E. Region). Contracts placed during February amounting to £369,669 include: Barking "C," turbo alternator casing, A.E.I. Deptford East, grit arresting plant, E. Green and Son. Chelsfield, 132 kV switchgear, English Electric. Medway, siteworks, M. J. Gleeson Ltd. Austin Canons, siteworks, J. A. Stirling Ltd. Colchester, 25 kV cabling, Pirelli-General Ltd. Earl Soham—Wickham Market, 132 kV o/h line works, Clough Smith and Co. Elstree, 132 kV cabling, B.I.C.C. Hemel Hempstead, 132 kV switchgear, A. Reyrolle and Co.

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

Aster. 801,567. Class 9. Discharge apparatus control appliances, etc. 801,567. Class 10. Lamps for medical purposes, etc. Thorn Electrical Industries Ltd., 105-109 Judd St, W.C.1.

Spabat. 814,072. Class 9. Batteries. Spafac Ltd., 9 North Pl, Cheltenham.

TRADE NOTES

Change of Address. The Association of Electrical Machinery Trades is now at 37 Soho Sq, W.1. Telephone: Gerrard 7107.

Licence. Under an agreement with R. B. Denison Manufacturing Co., Bedford, Ohio, U.S.A., Expert Industrial Controls Ltd. are to manufacture the complete range of Denison Loxswitches in the U.K.

New factory. Telcon Metals Ltd., a subsidiary of B.I.C.C., is to establish a factory at Auchterarder.

Representative. The Northern representative of Tyrad Ltd. has moved to "Hillside," Stubbing Rd, Marsden, near Huddersfield.

European Div. Dynamics Corporation of America have formed a European division with headquarters in London. The move is directed towards a major expansion of the company's European activities through licensing and marketing agreements and also through projected corporate acquisitions of European companies. D.C.A. already has a manufacturing sales base in England through its Winston Electronics subsidiary.

New Phone No. The telephone number of Cable Strippers Ltd. has been changed to Potters Bar 52267.

Reorganisation. Resulting from the reorganisation of the Telegraph Construction and Maintenance Co. Ltd., its Plastics Division has been formed into a new company with the title of Telcon Plastics Ltd. The latter concern will carry on the activities of the former Division at the same factory, i.e., Farnborough Wks, Green St Green, Orpington, Kent, as from 1 April.

. . . and Overseas

*Details of items marked * may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.*

4 April—America. Conductor a.c.s.r. (three items). U.S. Dept of the Interior, Bonneville Power Admin., P.O. Box 3537, Portland 8, Oregon. B.o.T. (ESB/10006/61).*

7 April—Thailand. 11 kV distribution transformers from 5 kVA to 100 kVA (seven items). Provincial Electricity Authority. B.o.T. (ESB/9694/61).*

7 April—Thailand. 2,000 of 3 A, 220 V, 500 of 5 A, 220 V and 500 5 A, 110 V kWh meters. Provincial Electricity Authority. B.o.T. (ESB/9696/61).*

9 April—Thailand. Four furnaces, a fume extractor and chemical salts. Directorate of Air Eng, Bang Sue. B.o.T. (ESB/9693/61).*

10 April—America. 11 3-pole 230 kV disconnecting switches. Dept. of the Interior, Bureau of Reclamation, C. S. Shisler, Contract-Pur. Unit, Bldg 53, Denver Federal Center. B.o.T. (ESB/9625/61).*

10 April—India. Paper insulated copper strip 0·05 in. to 0·16 in. by 0·18 in. to 0·54 in. wide for transformer windings. Shri D.P. Guzdar, Officer on Special Duty, Heavy Electricals Ltd., Crown Hse, Aldwych, W.C.2. Applications for documents by above date. B.o.T (ESB/9624/61).*

10 April—S. Africa. Two electronic counters. Secretary, Union Tender Board, 291 Bosman St, P.O. Box 371, Pretoria. B.o.T. (ESB/9429/61).*

11 April—Ceylon. 1,200 fluorescent fittings from 2 ft 20 W to 5 ft 80 W, for Ministry of Agriculture, Land, Irrigation and Power. Details from Crown Agents, 4 Millbank, S.W.1. B.o.T. (ESB/9189/61).

13 April—Pakistan. Cables, accessories, fittings and wire (35 items). Director-General of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/9606/61).

17 April—Pakistan. 1·1 kV grade p.i.l.c.d.s.w.a. cable (seven items). Director-General of Supply and Development, Frere Rd, Karachi. B.o.T. (ESB/9607/61).

19 April—Pakistan. Two 75 kW 50 c/s, 220/440 V diesel generators. Director of Supply, P.I.D.C. Hse, Motijheel, Dacca 2. B.o.T. (ESB/9465/61).

19 April—Thailand. Two 100 kVA, two 200 kVA, two 300 kVA and one 400 kVA 11/2·02 kV power transformers. Provincial Electricity Authority. B.o.T. (ESB/9697/61).*

21 April—S. Africa. 18,216 ft underground telephone cables for S.A. Railways. Chairman, Tender Board, P.O. Box 7784, Johannesburg. B.o.T. (ESB/9699/61).*

8 May—New Zealand.—Varnished cotton sleeving, radio grade (four items). Director-General (Stores Division), G.P.O., Wellington. B.o.T. (ESB/8975/61).

31 May—Hong Kong. Six vertical spindle pumps for two stations, each station having a capacity of 8 m.g.d. at 85 ft and 300 ft heads. Pumps to be complete with motors. Details from Crown Agents, 4 Millbank, S.W.1. Deposit £10. Reference E.C.2. Hong Kong 4757.

BUSINESS PROSPECTS

Aylesbury. B.C. propose factory, Gabehouse industrial estate, and two factories, Buckingham Rd. Constructors, M.E. Developments, Bushey Mill La, Watford.

Basildon New Town. Chesterfield Properties Ltd., Chesterfield St, W.1, propose cinema/shops, Long Riding and Southernhay, to cost £100,000.

Bedford. C.C. plan new divisional police H.Q. (£185,000). County architect.

Belfast. £150,000 branch bank Shaftesbury Sq, proposed for Ulster Bank Ltd., Waring St, Belfast.

Billingham-on-Tees U.D.C. Plan four blocks of ten-storey flats and 134 houses on Low Grange Redburn site.

Birmingham C.C. Tender: 29 two-storey dwellings, Elms Estate, Sheldon. City architect, Birmingham.

Blackburn. Blackburn Deanery plan secondary school at rear of Salisbury Parochial Hall.

Blackpool. Lewis's Ltd., department store proprietors, to erect new store, Palace buildings site, Promenade.

Bolton. Corporation Health Committee propose hostel for psycho-geriatric patients.

Bournemouth. Planned: five factories, Wallisdown Rd estate, for M. Chopper. Architect, A. Stewart, Old Christchurch Rd; planned: block of 11 shops, Commercial Rd, for Craddock Investment Trust Ltd.; five-storey block of shops/restaurant/offices/stores, Avenue Rd, for P. Jones.

Brighouse. A. Heaton (Valves) Ltd. propose works extensions, Livingstone Valve Wks, Bradford Rd.
for P. Jones.

Bristol. C.C. Planning Committee propose College of Science and Technology, Kings Weston. £250,000 ice rink/bowling centre, Wells St, proposed by Bristol Ice Rink Ltd. Architects: E. H. Button and Ptnr, Berkeley Sq. Proposed: offices/showrooms New Thomas St for J. Bryant Ltd., Stephen St, Broad Plain; warehouse for Bristol Warehouse Co. Ltd., architects: Stock, Page and Stock, 3 Fanshawe St, N.1. Grensham Investments Ltd., propose a £150,000 block of offices Redwood, Miles and Wills, George St, architects. Block of flats proposed at Stoke Bishop for Bartlet Investments Ltd. Architects: A. F. French and Ptnrs, Pearl Assurance Hse, Queens Sq, Bristol.

Bucks. C.C. Health Committee propose extensions to Newport Pagnell home for aged.

Burton C.B.C. Tender: 50 dwellings, Ferry St, Heath Rd. Architect.

Cardiff R.D.C. Tender: 25 flats for aged, Hollybush estate, Whitchurch. Engineer.

Carlisle. Planned: warehouse/office block, for Metal Box Co., Carlisle and Baker St, W.1.

Chatham B.C. Tender: 12 flats, Perry St. Engineer.

Chesham. Planned: block of shops with flats over for John English, Golding and Co. Ltd. Architect: A. E. Mellett, Wemborough Rd, Stanmore, Middx.

Cheshire. The R.C. Diocese of Shrewsbury plan 22 new schools in Cheshire towns. Manchester Regional Hospital Board propose improved X-ray and physiotherapy departments at Cranford Lodge Hospital, Knutsford.

Chester-Le-Street R.D.C. Propose 40 houses at Fatfield, and 12 old people's bungalows at Sacriston.

Croydon. R. White and Sons Ltd., Albany Rd, Camberwell, S.E.5, propose store bldg, Morland Rd; Mid-Century Microwavegear Ltd., Parsons Mead, propose test laboratory; Managers of Christchurch, Purley, C. of E. School, plan erection of primary school, Brighton Rd, Vicarage, Christchurch Rd; 42 dwellings planned for Beacon Investments Ltd., c/o Regency St, S.W.1; House Property Advice and Mortgage Assen Ltd., Harrow Rd, Wembley, plan 22 flats, Mowbray Rd.

Darwen. R.C. Authorities plan new St. Thomas Aquinas Secondary School, to cost £105,750.

Didcot. Extensions Didcot Hospital proposed by Nuffield Orthopaedic Group.

Doncaster R.D.C. Proposed this year erection 263 dwellings. Surveyor; T.C. bus station/bldgs/coach park on site of demolished houses, Spring Gdns; £23,000 civil defence H.Q., Union St. Surveyor; R.D.C. Walter Firth Ltd., Doncaster, awarded £18,760 contract for council office alterations.

Dumbarton R.B. Tender: erection 57 traditional houses, Barwood Hill. Clerk.

Dumfries. Proposed: seismic research station, Eskdalemuir, for U.K.A.E.A., Charles II St, S.W.1.

Eastbourne. F. G. Minter, Buckingham Palace Rd, S.W.1, contractors for development of extension site Compton Place Rd, for York and London Property Management Co. Ltd., Fenchurch St, E.C.3. First stage to be block of 38 flats to cost £250,000.

East Suffolk C.C. Tender: 27,000 sq ft modern school, Bacton, Stowmarket. County architect.

Edgware. Shops/offices, Station Rd, proposed by Equitable Debenture and Assets Corpn., 11 Park Pl, London S.W.1.

Exeter. Exeter Centre Properties Ltd., to erect shops, offices, etc., Paris St and Sidwell St.

Fleetwood. The R.C. Authorities plan Cardinal Allen Secondary School, to cost £164,422; and secondary school at Melbourne Ave, to cost £200,000.

Gateshead. Proposed by John T. Bell and Sons Ltd., Market St, Newcastle upon Tyne, a £750,000 hotel with 70-100 bedrooms near Berwick Rd.

Glasgow C.C. Several works tenders: Cleansing Depot, Easterhouse, and proposed primary schools at East Keppoch, Priesthill and South Nitshill. Architect; Taylor Woodrow Industrial Estates, Southall, Middx., plan redevelopment 35 acres industrial land.

Havant. Work soon 33,000 sq ft factory for Vinyl Products, Butter Hill, Carshalton.

Hebburn-on-Tyne U.D.C. Plan 100 houses on Ponds site.

Hounslow. Proposed £1 million shopping centre for Gala Investments. Architect: John MacAlpine.

Huddersfield. B.C. to approve provision of home for elderly at Rainwood estate, to cost £53,310.

Hull. Corporation proposes a home for the aged to cost £70,000.

Isle of Ely C.C. P. E. Rooke (Chatteris) Ltd., Chatteris, Cambs, awarded contract for first instalment of extensions at Queen's Girls' School, Wisbech.

Leeds. Wm. Airey and Son, Eldon Ho, Leeds 2, to build West Park factory for Wm. Rhodes, Carlton Cross Mills; Bovis Ltd., Stanhope Gate, W.1, to build £541,000 multi-storey offices for Yorkshire City Properties.

Leicester C.C. plan 202 dwellings Thurnby estate, cost £264,294. City architect.

Limavady U.D.C. Tender: 248 dwellings and ancillary works, cost £400,000. Clerk.

Lindsey C.C. Proposed new junior school on six-acre site, Westcliffe estate, Scunthorpe. County architect, Lincoln.

London. John Laing Construction, Mill Hill, to build Camden Rd offices/factory for Livingstone Laboratories; Ord, Carmell and Kritzler, Stamford Hill, N.16, architects for Winegartens Ltd. shops/offices: A. Jones and Allerton, High St, Bromley, architects for warehouse/offices, Chapter St; second stage Royal College of Art development, architect, H. J. Cadbury-Brown, Clarges St, W.1; Ronald Ward and Ptnrs, architects, Chesham Pl, S.W.1, plan shops/offices/flats/showrooms, Gloucester Rd Station; proposed Cromwell Rd service tower by Sir John Burnett, Tait and Ptnrs, Bedford Sq, W.C.1; shops and offices, Vauxhall Bridge Rd and Willow Pl, by C. E. Ball and Ptnrs, Fitzroy Sq, W.1; Stock, Page and Stock, architects, Fanshawe St, N.1, propose offices/flats, New Cross Rd; Julian Sotaer, Montague Sq, W.1, plans flats, Hyde Pk nursery, Greenwich; Trollope and Colls, Noble St, E.C.2, to build new Salvation Army H.Q.; shops/offices, Old St and Cowper St, proposed by Aston and Freeman, Oxendon St, W.1; W. S. Hattrell and Ptnrs, Cleveland Pl, S.W.1, architects, proposed £170,000 six-storey offices, Stanhope Gate; flats planned, Upper Berkeley St, Seymour Pl, W.1, architects, Yorke, Rosenberg and Mardell, 2 Hyde Pk Pl, W.2; planned by H. H. Ford, architect, 35 South Audley St, London W.1, erection of a 14-storey hotel, Jermyn St, Duke St, S.W.1; proposed by R. Fielding, architect, Aldwych, London W.C.2, office bldg with flats, Northumberland Ave, W.C.2.

Luton. Plans: industrial development Cradock Rd for Ronald Lyon (Estates) Ltd., Hersham, Walton-on-Thames; factory extension, Reginald St, for Thomas Thorne and Co., 17 Chapel St, Luton; planned: extensions, hat factory at 69-71 Latimer Rd for J. C. Kershaw and Co. Ltd; extensions to factory, Farley Hill, for Graham (Jute) Ltd.; extensions to factory, stores and warehouse, High Town Rd, for A. E. Waller (Eng.) Ltd.; Calgary and Edmonton Land Co. Ltd., Avenue Rd, London N.W.8, plan shops, offices at Crawley Rd, New Bedford Rd.

Manchester. Apprentice training school, West Gorton, proposed by Ferranti Ltd., West Gorton Wks, Manchester 12; Corporation proposes a hostel for mentally disordered at Brougham St, West Gorton; aged persons' homes at Harpurhey redevelopment area, and at Woodhouses Park, and a day centre and club at Victoria Park; tender: Managers of St. Francis R.C. primary school propose new school premises; R.C. Diocese of Salford plan secondary school at Beverley St, Blackley; Regional Hospital Board, Cheetwood Rd, Manchester 8, propose second phase of Wythenshawe Hospital and maternity block and operating theatre Withington Hosptal.

Mansfield. Factory canteen proposed Botany Ave for Mansfield Hosiery Mill Ltd.

Monmouthshire. County Council has accepted the £63,919 tender of W. and E. Davies Ltd., Snatchwood Rd, Abersychan, Pontypool, Mon, for the erection of a new home for the aged at Nantyglo. Work has commenced.

Neath R.D.C. Tender: 16 flats, Skewan. Engineer.

Newcastle upon Tyne. Welbar Development Ltd., King St, E.C.2, plan office block at Gallowgate; Regional Hospital Board, Benfield Rd, Newcastle upon Tyne, fourth stage of Prudhoe and Monkton Hospital, Northumberland. Cost: £250,000. M. White, 11 Tynedale Terr, is architect for Stoddart St factory for Julius Bernet Ltd.—C.C. plan £73,000 Denton Burn old people's home and £15,000 child welfare centre at Fawdon.

Newport I.W. Planned: secondary school in Priory Farm estate for Portsmouth R.C. Diocesan Trustees.

North Wales. Factory, Rhyl, proposed by Industrial Estates Management Corporation of Wales for occupation by Marston Lubricants Ltd., Rockferry Oil Wks, Birkenhead. Corp architect, Treforest industrial estate, Pontypridd.

Nottingham. Two halls of residence to cost £750,000 proposed by Senate of University of Nottingham.

Oban B.C. Tender: 162 dwellings, two shops, Corran Brae housing development. Morham and Brotchie, surveyors, Shore St.

Oldham. Manchester Regional Hospital Board, Cheetwood Rd, Manchester 8, plan twin operating theatres at Oldham General Hospital, estimated to cost £133,500.

Peterborough. Adcocks (Peterborough) Ltd., plan £20,000 works/depot reconstruction. Huntley Grove.

Peterhead. Allen and Frisken, Castle St, Dundee, architects for factory to be erected for Radiation Ltd.

MEETINGS TO NOTE

THURSDAY, 30 MARCH

A.S.E.E. (N. Ireland). "Some Industrial Applications of Magnetic Power," T. G. Hawker. Central Hall, Rosemary St, Belfast.

A.S.E.E. (S. London). "Electricity in the Food Supply Industry," C. R. Ayling. Greyhound Hotel, High St, Croydon. 8 p.m.

TUESDAY, 4 APRIL

I.E.E. (S.E. Scotland). "A General Theory of Depreciation of Engineering Plant," D. Rudd. Carlton Hotel, Edinburgh. 7 p.m.

A.S.E.E. (Reading and Districts). "Current Trends in Winding Wire Manufacture," A. J. Taylor. College of Further Education, Bourne Rd, Maidenhead. 7.30 p.m.

A.S.E.E. (S.E. London). "Domestic Appliances," Miss Lois Stevens. Eltham Green School, Queenscroft Rd, Eltham, S.E.9. 7.45 p.m.

A.S.E.E. (W. London). "Colour Photography." "White Hart," 49 King's Rd, Chelsea, S.W.3. 7.45 p.m.

WEDNESDAY, 5 APRIL

I.E.E. (Tees-side). "Short-circuit Ratings for Mains Cables," G. S. Buckingham. Cleveland Scientific and Technical Institution, Middlesbrough. 6.30 p.m.

I.E.E. (Southern). A.G.M. and Third Hunter Memorial Lecture: "The Application of Electronics to the Electricity Supply Industry," J. S. Forrest. Main Hall, College of Technology, Portsmouth. 6.30 p.m.

I.E.E. (Bedfordshire). "An Engineering Project in India," Major H. E. Knight. Swan Hotel, Bedford. 7 p.m.

I.E.S. (Edinburgh). A.G.M. Y.M.C.A. Social Room, 14 South St. Andrews St. 6.15 p.m.

I.E.S. (Newcastle). "Design Criteria for Integrated Lighting in Buildings," Derek Phillips. Room B7, The Percy Bldg, King's College, Queen Victoria Rd. 6.15 p.m.

INCORPORATED SALES MANAGERS' ASSOCIATION. "How to Sell Point-of-Sale Advertising," R. F. T. Edwards. Caxton Hall, S.W.1. 6.30 p.m.

INSTITUTE OF PHYSICS AND PHYSICAL SOCIETY. Symposium on "Electrical Contacts" at Brunel College of Technology, W.3, until 7 April.

A.S.E.E. (Manchester). "Modern Temperature Control Systems," C. Cowell. The Engineers' Club, Albert Sq. 7.15 p.m.

A.S.E.E. (Preston). "Engineering Aspects of 33 kV Cable Installations." R.A.F.A. Club, East View. 7.30 p.m.

THURSDAY, 6 APRIL

I.E.E. "Technical and Economic Aspects of the Supply of Reactive Power in England and Wales," W. Casson and H. J. Sheppard. Savoy Pl, W.C.2. 5.30 p.m.

INSTITUTION OF CIVIL ENGINEERS. "River Utilisation and the Preservation of Migratory Fish Life," G. Baxter. Gt. George St, S.W.1. 5.30 p.m.

PLASTICS INSTITUTE (Southern). "Recent Developments in the Use of Acetal Resins," G. F. C. Barrett. Chemistry Dept., University of Southampton. 7.30 p.m.

I.E.S. (Nottingham). "Ship Lighting," A. E. Fothergill. Electricity Centre, Carrington St. 6 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (Television Group). Discussion: "Transistorised Television Receivers," London School of Hygiene and Tropical Medicine, Keppel St, W.C.1. 5.30 p.m.

BRITISH INSTITUTION OF RADIO ENGINEERS (N.W. Section). "Plant Investigation and Control Using Digital Techniques," K. J. McCarthy. Reynolds Hall, College of Technology, Manchester 1. 7 p.m.

I.E.E. (Bristol Graduates and Students). "Transformer Development," F. G. Pratt. Electricity Hse, Colston Ave. 7 p.m.

INTERNATIONAL AUDIO FESTIVAL AND FAIR at Hotel Russell, W.C.2, until 9 April.

A.S.E.E. (Brighton, Hove and District). "Electrical Application to the Paper Industry," A. Castle. New Imperial Hotel, First Ave, Hove. 7.30 p.m.

FRIDAY, 7 APRIL

I.E.E. (Medical Electronics Group). Discussion: "The Conversion of Biological Data into Electrical Signals." Savoy Pl, W.C.2. 6 p.m.

I.E.E. (Southern). "Subscriber Trunk Dialling," D. A. Barron. S.E.B. Showrooms, Newport, I.o.W. 6.30 p.m.

I.E.E. (Southern). Annual dinner/dance. Old Ship Hotel, Brighton.

SOCIETY OF INSTRUMENT TECHNOLOGY (Fawley). A.G.M. Admin. Bldg, Esso Refinery. 5.30 p.m.

A.S.E.E. Annual dinner at Grosvenor Hse, Park La, W.1.

MONDAY, 10 APRIL

I.E.E. (Electronics and Communications Section). Discussion: "Applications of Electrical Phenomena at Liquid Helium Temperatures." Savoi Pl, W.C.2. 5.30 p.m.

I.E.E. (Mersey and N. Wales). A.G.M. and "The Mechanism of Lightning," Professor J. M. Meek. Royal Institution, Colquitt St, Liverpool. 6.30 p.m.

I.E.E. (N.E. Measurement and Electronics Group). A.G.M. and "Some Aspects of the Application of Electronics to Medicine." Rutherford College of Technology, Northumberland Rd, Newcastle upon Tyne. 6.15 p.m.

I.E.E. (S. Midlands). "Development of 'Off-Peak Heating' with Particular Reference to Floor-warming," S. C. Dinenage. (Joint meeting with Supply and Utilisation Group.) College of Technology, Gosta Green. 6.30 p.m.

I.E.E. (Western). "Speed Changing Induction Motors—Further Developments in Pole-Amplitude Modulation," Professor G. H. Rawcliffe and W. Fong. Bristol University. 6 p.m.

N.E. ELECTRICAL CLUB. "Whisky," J. J. Priestley. County Hotel, Neville St, Newcastle upon Tyne. 6.30 p.m.

SOCIETY OF INSTRUMENT TECHNOLOGY (Manchester). "Industrial Application of TV." Nags Head, Jacksons Row. 6.45 p.m.

I.E.S. (Sheffield). A.G.M. and lighting forum. Grand Hotel. 6.30 p.m.

SOCIETY OF ENGINEERS. "The Use of Electric Light and Heat in Horticulture," A. E. Cranham. Geological Society, Burlington Hse, W.1. 5.30 p.m.

TUESDAY, 11 APRIL

I.E.E. (Measurement and Electronics Sections). "Precision Instruments for Coaxial Line Measurements up to 4Gc/s," D. Woods; and "The Concept of Equivalent Source E.M.F. and Equivalent Available Power in Signal-Generator Calibration," D. Woods. Savoy Pl, W.C.2. 5.30 p.m.

GAZETTE ANNOUNCEMENTS

COMPANIES ACTS

Astoria Electrics Ltd. Creditors to send details to liquidator: B. Goodwin, 111 Moorgate, E.C.2, by 5 April.

Turbo Electric Ltd. Meeting of creditors to be held at Prince of Wales Hotel, Lord St, Southport, on 7 April, at 12 noon, for the purpose of having an account of the winding-up laid before them.

Graham Electrics Ltd. Meetings of members and creditors to be held at offices of W. H. Cork, Gully and Co., 19 Eastcheap, E.C.3, on 4 April, at 12.15 and 12.30 a.m., respectively.

Ernest Stevens Ltd. Creditors to send details to liquidator: D. Spencer, 11 St. James's Rd, Dudley, by 7 April.

Wrights Midland Electrical Co. Ltd. Meetings of members and creditors to be held at 126 Colmore Row, Birmingham 3, on 5 April, at 2.30 and 2.45 p.m., respectively, for the purpose of having an account of the winding-up laid before them by the liquidator.

Vicspur Ltd. Meetings of members and creditors to be held at 76 New Cavendish St, W.1, on 7 April, at 11 and 11.30 a.m., respectively, for the purpose of having an account of the winding-up laid before them by the liquidator.

W. Doubleday Ltd. Mr T. J. W. Evans, 45 William St, Stockton-on-Tees, appointed liquidator at extraordinary general meeting on 27 Feb. for the purpose of winding-up. Mr R. W. Hellyer, Brotherton Chmbrs, Westgate, Leeds 1, appointed liquidator at subsequent meeting of creditors.

BANKRUPTCY ACTS

Receiving Order

Bradford. K. Ashmore, electrical dealer and contractor, carrying on business as K. Ashmore Electrical Contractors, at 939 Wakefield Rd, Bradford; and at 80 Leeds Rd, Windhill, Shipley; and at 370 Leeds Rd, Bradford, as R.S.M. Sewing Machines. Receiving order dated 16 March.

Intended Dividends

Brighton. A. L. Lankester, building and electrical contractor, carrying on business at 65 St. Thomas's Rd, Worthing. Last day for receiving proofs for intended dividend: 7 April, to trustee: J. S. Bradley-Hole, 7 Old Steine, Brighton 1.

Bristol. G. S. R. Maggs, formerly carrying on business as G.M.C. Electrical Co., at 3 Regent St, Clifton. Last day for receiving proofs for intended dividend: 7 April, to trustee: G. W. Sisman, 26 Baldwin St, Bristol 1.

Dividends

Birmingham. A. Fielder, radio and electrical retailer, carrying on business at 314 Shortheath Rd. Erdington, and 4 Cooksey La. Dividend per £: 6¼d, payable at Official Receiver's Office, Somerset Hse, 37 Temple St, Birmingham 2, on 31 March.

Rochdale. J. V. Lythgoe and T. O'Brien, carrying on business as Swift Clean Vac Shop, at 385 Halifax Rd, and lately at 94-96 Cheetham St, Rochdale. Dividend per £: 1s 6¼d, payable at 8 Manchester Rd, Bury, Lancs, on 31 March.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Centralex Ltd., 283 Green Lanes, Palmers Green, N.13. Electricians, mechanical engineers, etc. Nom. cap.: £500. Dirs.: Lorne Mel Scott-Chambers, Leslie S. Brown and Kenneth J. Adney.

Clarke's Lampshades Ltd. Nom. cap.: £100. Dirs.: Mrs Monica A. Taylor, 270 St. Mary's Rd, Edmonton, N.9; Mrs Joy M. Munday and Margaret Clarke.

William Dalton and Son (Electricians) Ltd., 82 Conran St, Harpurhey, Manchester 9. Nom. cap.: £5,000. Dirs.: Daniel Dalton, Geo. Dalton and Cyril Walker.

Defrostomatic (G.B.) Ltd., Balfour Hse, Finsbury Pavement, E.C.2. To carry on business of import and export agents, etc. Nom. cap.: £5,000. Dirs.: Julien Racine, Charles Caplin and Henry C. Rudolf.

Elliott-Litton Ltd., Century Wks, Lewisham, S.E.13. Manufacturers of and dealers in microwave, electron and similar tubes, etc. Nom. cap.: £100. Dirs.: not named. Subs.: I. Gower Williams and J. M. Beale.

J. H. Gibbons Ltd., 12 Bow La, E.C.4. Nom. cap.: £100. To carry on business of electricians, etc. Dirs.: John H. Gibbons and Mrs D. A. Gibbons.

Hawkey, Jenden and Co. Ltd., 137 Durham Rd, Stockton-on-Tees. Electrical engineers, general electrical and refrigeration contractors, etc. Nom. cap.: £3,000. Dirs.: George L. Fordy, George M. Fordy, Derek Hawkey and Bertram Jenden.

Lighting Components Ltd. Nom. cap.: £100. Dirs.: to be appointed by subs. Subs.: Richard B. Catlow, 62 London Wall, E.C.2; and Graham C. M. Young.

J. F. Millward (Liverpool) Ltd. Electrical equipment manufacturers and dealers, etc. Nom. cap.: £2,000. Dirs.: to be appointed by subs. Subs.: Dorothy M. Graeme and Paul G. Graeme, 61 Fairview Ave, Gillingham.

Whitesmith Ltd., 68 Argyle St, Birkenhead. To carry on the business of electricians, etc. Nom. cap.: £5,000. Dirs. not named. Subs.: Gerald A. Gould and David E. Reynolds.

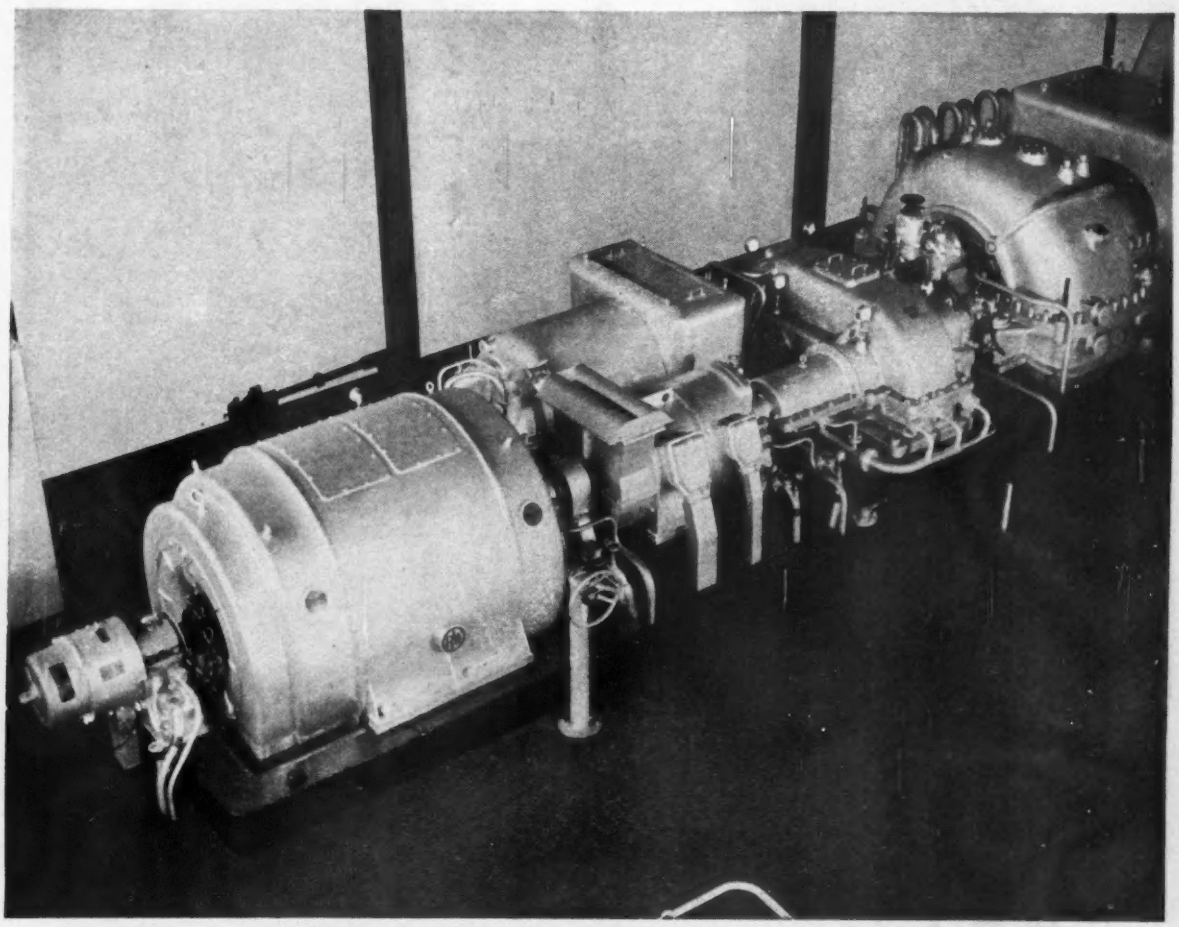
We are exhibiting on Stand 7, Row G, Ground Floor, at the Engineering, Marine, Welding & Nuclear Energy Exhibition, Olympia, April 20th to May 4th, 1961.

POWER W G

SHELTON IRON & STEEL LTD

THE ONLY GAS TURBINE IN GREAT BRITAIN OPERATING ON BLAST FURNACE GAS.

During the period May 1959—January 1961 this machine had in excess of 11,000 running hours to its credit, inclusive of a one month shut-down period for routine maintenance. Manufactured at our Hartlepool Works to Brown Boveri design.



RICHARDSONS WESTGARTH (HARTLEPOOL) LTD.

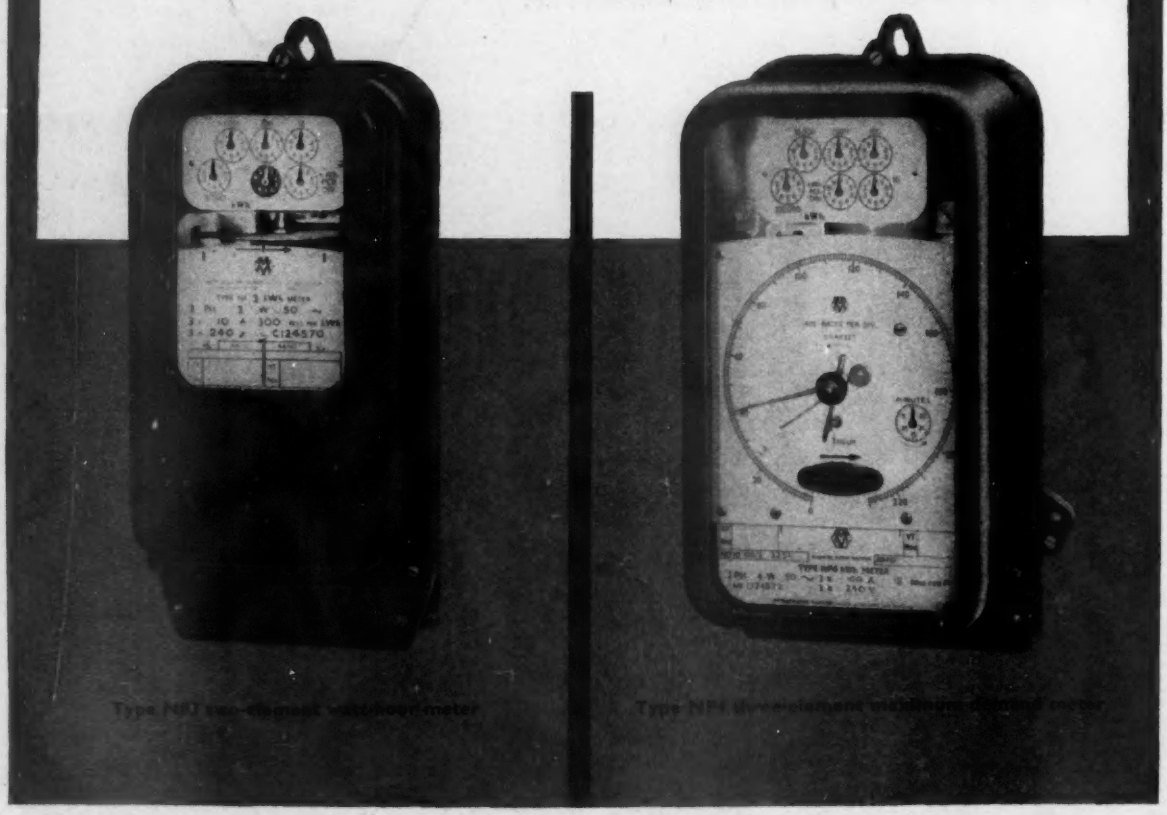
A member of the RICHARDSONS WESTGARTH GROUP
HARTLEPOOL, CO. DURHAM AND AT 58 VICTORIA STREET, LONDON, S.W.1.
59 MOSLEY STREET, MANCHESTER, 75 BUCHANAN STREET, GLASGOW

RW76

Accent on Accuracy

WITH THE TYPE NF SERIES

The type NF3 (two-element) and NF4 (three-element) watt-hour and maximum demand meters have been designed to meet present day requirements for overall accuracy. Their easily accessible adjustments, lightweight construction and handsome appearance, will commend themselves to all users. The meters comply in all respects with British Standard 37: Part 4: 1954 and Part 5: 1955.



For further information please write for 'The Art of Metering', which gives full details of these meters, to your local AEI office or direct to:

AEI

Associated Electrical Industries Ltd.
Instrumentation Division — Instrument & Meter Department
TRAFFORD PARK, MANCHESTER 17

G/A 801

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

COUNTY BOROUGH OF IPSWICH
Electrical Installation St. Matthew's Baths, Ipswich

TENDERS are invited for the above work, a specification for which may be obtained from the Borough Engineer and Surveyor, 19 Tower St, Ipswich, on payment of a deposit of £3 3s, returnable on receipt of a bona fide tender. Tenders, in plain sealed envelopes, bearing no name or mark to indicate the sender and endorsed "Tender for Electrical Installation, St. Matthew's Baths," must be forwarded to the undersigned not later than 10 a.m. on Monday, 1 May, 1961.

The Council does not bind itself to accept the lowest or any tender.

J. C. NELSON,
Town Clerk.

Town Hall,
Ipswich. (A 269)

STAFFORDSHIRE COUNTY COUNCIL EDUCATION COMMITTEE
New College of Technology, Stafford

TENDERS are invited for the supply of Electrical Batteries and Battery Chargers. Forms of Tender may be obtained from the Director of Education (Supplies), County Education Offices, Earl St, Stafford. Completed tenders enclosed in the envelope provided must be received by the undersigned at County Bldgs, Martin St, Stafford, not later than noon, Saturday, 29 April, 1961.

T. H. EVANS,
Clerk of the County Council.
(A 270)

COUNTY BOROUGH OF WALLASEY
Electrical Installation-Maisonnettes, Mersey Street

TENDERS, to reach the undersigned by 20 April, 1961, are invited for the electrical installation to 46 maisonnettes in the Mersey Street Area. Specification and Forms of Tender available from the Borough Architect, Town Hall, Wallasey.

A. G. HARRISON,
Town Clerk.
(A 265)

BOROUGH OF RHONDDA
New Street Lighting

TENDERS are invited for the supply, delivery and erection of Group "A" Sodium Vapour street lighting units complete with pre-stressed spun concrete columns and steel columns on approximately 10½ miles of classified roads in the Borough.

Forms of Tender, Specification and Bill of Quantities may be obtained from Mr E. T. T. Rees, A.M.I.C.E., A.M.I.W.E., Borough Engineer and Surveyor, Municipal Offices, Pentre, Rhondda, on receipt of a stamped addressed envelope. Detail plans and General Conditions may be inspected, by arrangement, at the Borough Surveyor's Office.

Tenders in envelopes provided and endorsed "Street Lighting" are to be delivered to the undersigned not later than Monday, 24 April, 1961.

The Council do not bind themselves to accept the lowest or any tender.

E. D. WILDE,
Town Clerk.

Municipal Offices,
Pentre, Rhondda.
22 March, 1961. (A 253)

FLINTSHIRE COUNTY COUNCIL
A.550—Lighting of Penymynydd Roundabout

TENDERS are invited for the above comprising provision and erection of one distribution pillar, eight lighting columns with 30 ft mounting height and 200 W sodium cut-off lanterns, four fluorescent lighting units for Advance Direction signs and the wiring of eight lighting columns and 12 Keep Left bollards to distribution pillars.

Tender documents obtainable from E. W. W. Richards, ESQ., A.M.I.C.E., A.M.I.STRUCT.E., A.M.I.MUN.E., County Surveyor, Llwynegrin, Mold.

Tenders in plain sealed envelope marked "17/4 Lighting at Penymynydd" should reach the undersigned not later than noon on Monday, 17 April, 1961.

W. HUGH JONES,
Clerk of the County Council.

County Bldgs,
Mold. (A 199)

COUNTY BOROUGH OF SUNDERLAND

TENDERS are invited for Electrical Installation in 305 Dwellings. Tender documents obtainable from Borough Architect, Grange Hse, Stockton Rd, Sunderland. Sealed tenders, endorsed "Tender for Electrical Installation—305 Dwellings, Town End Farm Estate," must be received at my office, Town Hall, not later than 18 April, 1961.

G. S. McINTIRE,
Town Clerk.
(A 264)

SHEFFIELD CORPORATION WATERWORKS
Yorkshire Derwent Scheme
Tenders for Power Equipment

TENDERS are invited from Electrical Equipment Manufacturers for the supply and installation of:

11 kV/3·3 kV, 3·3 kV/415 V transformers, totalling 13,000 kVA.
3·3 kV Air Break Switches.
3·3 kV Motor Contactor Starters
and other electrical equipment for this Scheme.

Persons wishing to tender should apply for the necessary documents which will include instructions regarding the method and date of submission, to the General Manager and Engineer, Waterworks Office, Castle Market Bldg, Sheffield 1. (A 274)

APPOINTMENTS VACANT

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area
THIRD ASSISTANT ENGINEER—CONTROL
(SHIFT DUTIES)
SYSTEM CONTROL CENTRE
CHALTON, Nr. LUTON
54/61.R.

Candidates should have had a sound technical training and wide experience of switching operations and maintenance work on H.V. distribution systems. Candidates

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should be fully conversant with the Central Electricity Safety Rules (Distribution) and should have a knowledge of protective systems.

Salary: N.J.B. Class L, Grade 10 (£1,190/£1,325), plus 10% Shift Allowance.

Apply by letter by 7 April, 1961, to the Manager, Chilterns Sub-Area, Eastern Electricity Board, Prebend St, Bedford.

Essex Sub-Area
GENERAL ASSISTANT ENGINEER
OPERATION AND MAINTENANCE SECTION
SUB-AREA HEADQUARTERS
Nr. BRENTWOOD
55/61.R.

Candidates should have had a sound technical training and possess the Higher National Certificate or equivalent qualification.

Salary: N.J.B. Class L, Grade 14 (£890/£1,015), plus London Allowance.

Apply by letter, by 7 April, 1961, to the Engineer, Essex Sub-Area, Eastern Electricity Board, "Millfield," Bentley, Nr. Brentwood, Essex.

Suffolk Sub-Area
MANAGER
COLCHESTER DISTRICT
56/61.R.

In view of the approaching retirement of Mr. G. P. Dixon, applications are invited for the above appointment.

Candidates should possess sound commercial engineering and administrative experience in posts with managerial responsibility in electricity undertakings with both urban and rural characteristics. Corporate Membership of the Institution of Electrical Engineers will be regarded as an additional qualification.

Salary: N.J.M. Class C, Grade 5 (£2,170/£2,380).

Apply by letter, by 7 April, 1961, to the Manager, Suffolk Sub-Area, Eastern Electricity Board, Finborough Hall, Stowmarket, Suffolk. (A 230)

CENTRAL ELECTRICITY GENERATING BOARD
South Eastern Division
LITTLEBROOK POWER STATION
Vacancy No. 103/61.
ASSISTANT ENGINEER (CONTROL)

APPLICANTS should have had experience with the control of modern turbo generators and E.H.T. switchgear. They should preferably hold at least O.N.C. (Electrical).

Salary: N.J.B. Class L, Grade 13, £1,111 10s/£1,249 per annum including London and Shift Allowances.

Applications giving age, details of experience, qualifications, etc., should be sent to the Station Superintendent, Littlebrook Power Station, nr. Dartford, Kent, to arrive by 17 April.

W. H. DUNKLEY,
Divisional Controller.
(A268)

CORPORATION OF GLASGOW
Architectural and Planning Department
ASSISTANT ENGINEER (ELECTRICAL)

APPLICATIONS for the above superannuable appointment are invited from graduates and associate members of the Institution of Electrical Engineers. Salary scale: £850/£1,560, with placing according to qualifications and experience. There is a point within the scale at which increments may be accelerated.

A five-day week is in operation.

Advances up to 100% of valuation will be made available where needed for the purchase of suitable houses in or near Glasgow, to successful applicant.

Form of application may be obtained from the Principal Administrative Officer, Architectural and Planning Department, 20 Trongate, Glasgow C.1.

A. G. JURY,
City Architect and Director of Planning.
(A 228)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 46s. per inch, and all other classified advertisements at 3s. 6d. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD

East Midlands Division

ASSISTANT ENGINEERS (RELIEF) DRAKELOW "A" POWER STATION

Vacancy No. 50/61.

APPLICATIONS are invited for the positions of Assistant Engineers (Relief) at Drakelow Power Station, near Burton-on-Trent, Staffs.

Applicants should have received a sound electrical training and have had experience of the operation and control of modern high-pressure boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering or its equivalent.

Salary will be in accordance with Class J, Grade 12 (£890/£1,015 per annum) of the National Joint Board Agreement, plus 10% allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT PLANNING ENGINEER DRAKELOW "A" AND "B" POWER STATIONS

Vacancy No. 51/61.

Applications are invited for the position of Planning Engineer at Drakelow "A" and "B" Power Stations, near Burton-on-Trent, Staffs.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are Corporate Members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 8 (£1,440/£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEERS (RELIEF) LINCOLN POWER STATION

Vacancy No. 52/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Lincoln Power Station, Spa Rd, Lincoln.

Applicants should have received a sound electrical training and have had experience in the operation of boiler and turbine plant. Preference wil lbe given to candidates who possess the Higher National Certificate in mechanical or electrical engineering, or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class F, Grade 12 (£715/£805 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEER (RELIEF) DERBY POWER STATION

Vacancy No. 53/61.

Applications are invited for the position of Assistant Engineer (Relief) at Derby Power Station, Full St, Derby.

Applicants should have received a sound technical training and have had experience in the operation of boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering, or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class F, Grade 12 (£715/£805 per annum of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEERS (RELIEF) NORTHAMPTON POWER STATION

Vacancy No. 54/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Northampton Power Station, Houghton Rd, Northampton.

Applicants should have received a sound electrical training and have had experience in the operation of boiler and turbine

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plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering, or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class G, Grade 12 (£765/£870 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT CONTROL ENGINEER (RELIEF) NORTHAMPTON POWER STATION

Vacancy No. 55/61.

Applications are invited for the position of Assistant Control Engineer (Relief) at Northampton Power Station, Houghton Rd, Northampton.

Candidates for this post should be suitably qualified and have had experience in the control room.

Salary will be in accordance with Class G, Grade 13 (£715/£805 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEERS (RELIEF) COVENTRY POWER STATION

Vacancy No. 56/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Coventry Power Station, Alderman's Green, Coventry.

Applicants should have received a sound electrical training and have had experience in the operation of boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering, or who ar at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class G, Grade 12 (£765/£870 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEERS (RELIEF) WARWICK POWER STATION

Vacancy No. 57/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Warwick Power Station, Emscote Rd, Warwick.

Applicants should have received a sound electrical training and have had experience in the operation of boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering, or who are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class E, Grade 12 (£670/£750 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

SECOND ASSISTANT STATION CHEMIST STAYTHORPE "A" AND "B" POWER STATIONS

Vacancy No. 58/61.

Applications are invited for the position of Second Assistant Station Chemist at Staythorpe "A" and "B" Power Stations, near Newark, Notts.

Candidates should have had previous experience in a power station laboratory and should hold the Higher National Certificate in Chemistry. They should be familiar with the methods of sampling and analysis of coal, water and oil and with the interpretation and application of the analytical results.

Salary will be in accordance with Class M, Grade 11 (£1,190/£1,325 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 7 April, 1961.

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ASSISTANT PLANNING ENGINEER STAYTHORPE "A" AND "B" POWER

Vacancy No. 59/61.

Applications are invited for the position of Assistant Planning Engineer at Staythorpe "A" and "B" Power Stations, near Newark, Notts.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are Corporate Members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 8 (£1,440/£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT EFFICIENCY ENGINEER STAYTHORPE "A" AND "B" POWER STATIONS

Vacancy No. 60/61.

Applications are invited for the position of Assistant Efficiency Engineer at Staythorpe "A" and "B" Power Stations, near Newark, Notts.

Applicants should have held a position of responsibility in a modern power station and should have received a thorough practical and theoretical training.

Preference will be given to candidates who are Corporate Members of a recognised professional institution or who hold qualifications leading to such membership.

Salary will be in accordance with Class M, Grade 8 (£1,440/£1,610 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEERS (RELIEF) HIGH MARNHAM POWER STATION

Vacancy No. 61/61.

Applications are invited for the positions of Assistant Engineers (Relief) at High Marnham Power Station, near Newark, Notts.

Applicants should have received a sound electrical training and have had experience of the operation and control of modern high-pressure boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering or its equivalent.

Salary will be in accordance with Class N, Grade 12 (£1,190/£1,325 per annum) of the National Joint Board Agreement, plus 10% allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

STATION SHIFT CONTROL ENGINEER WILLINGTON "A" POWER STATION

Vacancy No. 62/61.

Applications are invited for the position of Station Shift Control Engineer at Willington "A" Power Station, P.O. Box 27, Derby.

Applicants should have had a good general education and technical training with practical experience in the control and operation of large modern switchgear. Preference will be given to candidates who possess technical qualifications to Higher National Standard.

Salary will be in accordance with Class L, Grade 10 (£1,190/£1,325 per annum) of the National Joint Board Agreement, plus 10% allowance for shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEER (RELIEF) BURTON ON TRENT POWER STATION

Vacancy No. 63/61.

Applications are invited for the position of Assistant Engineer (Relief) at Burton-on-Trent Power Station, Wetmore Rd, Burton-on-Trent, Staffs.

Applicants should have received a sound electrical training and have had experience in the operation of boiler and turbine plant. Preference will be given to candidates who hold the Higher National Certificate in mechanical or electrical engineering, or who

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are at present pursuing a course of study with the object of obtaining this or a similar qualification.

Salary will be in accordance with Class E, Grade 12 (£670/£750 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEERS (CONTROL ROOM)
LEICESTER POWER STATION
Vacancy No. 64/61.

Applications are invited for the positions of Assistant Engineers (Control Room) at Leicester Power Station, Rawdykes Rd, Leicester.

Candidates for this post should be suitably qualified and have had experience in the control room.

Salary will be in accordance with Class G, Grade 13 (£715/£805 per annum) of the National Joint Board Agreement, plus £90 per annum allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEERS (RELIEF)
CASTLE DONINGTON POWER STATION
Vacancy No. 65/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Castle Donington Power Station, near Derby.

Applicants should have received a sound electrical training and have had experience of the operation and control of modern high-pressure boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical engineering or its equivalent.

Salary will be in accordance with Class L, Grade 12 (£1,040/£1,165 per annum) of the National Joint Board Agreement, plus 10% allowance whilst engaged on shift duties.

Closing date for receipt of applications: 7 April, 1961.

ASSISTANT ENGINEERS (CONTROL ROOM)
STAYTHORPE "A" POWER STATION
Vacancy No. 68/61.

Applications are invited for the positions of Assistant Engineers (Control Room) at Staythorpe "A" Power Station, near Newark, Notts.

Candidates for this post should be suitably qualified and have had experience in the control room.

Salary will be in accordance with Class K, Grade 14 (£825/£940 per annum) of the National Joint Board Agreement, plus an allowance whilst engaged on shift duties.

Closing date for receipt of applications: 14 April, 1961.

ASSISTANT COAL AND ASH HANDLING ENGINEER
SPONDON POWER STATION
Vacancy No. 69/61.

Applications are invited for the position of Assistant Coal and Ash Handling Engineer at Spondon Power Station, Thulston Rd, Borrowash, near Derby.

Candidates should have knowledge of the operation of coal, ash and dust handling plant at a large modern power station, and of the organisation and planning of coal supplies by road and rail.

The duties of the successful candidate will include the organisation of ash disposal by lorry transport.

Salary will be in accordance with Class J, Grade 10 (£1,040/£1,165 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 14 April, 1961.

SECOND ASSISTANT STATION CHEMIST
SPONDON POWER STATION
Vacancy No. 70/61.

Applications are invited for the position of Second Assistant Station Chemist at Spondon Power Station, Thulston Rd, Borrowash, near Derby.

Candidates should have had previous experience in a power station laboratory and should hold the Higher National Certificate in Chemistry. They should be familiar with the methods of sampling and analysis of coal, water and oil and with the interpreta-

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tion and application of the analytical results.

Salary will be in accordance with Class J, Grade 11 (£965/£1,090 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 14 April, 1961.

ASSISTANT ENGINEERS (RELIEF)
SPONDON POWER STATION
Vacancy No. 71/61.

Applications are invited for the positions of Assistant Engineers (Relief) at Spondon Power Station, Thulston Rd, Borrowash, near Derby.

Applicants should have received a sound electrical training and have had experience of the operation and control of modern high-pressure boiler and turbine plant. Preference will be given to candidates who possess the Higher National Certificate in mechanical or electrical enginering or its equivalent.

Salary will be in accordance with Class J, Grade 12 (£890/£1,015 per annum) of the National Joint Board Agreement, plus 10% allowance whilst engaged on shift duties.

Closing date for receipt of applications: 14 April, 1961.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT, which may be obtained from the Station Superintendent concerned, and should be returned to him by the date stated.

O. S. WOODS,
Divisional Controller.

24 March, 1961. (A 281)

MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited for the following superannuable posts:

Board Headquarters

SECOND ASSISTANT ENGINEER
(OPERATIONS)
(CHIEF ENGINEER'S DEPARTMENT)

Duties will include work in connection with protective gear schemes of all types, with fault investigations and with other matters associated with the operation of the Board's high voltage systems. Candidates should have a good knowledge of the design and application of all types of protective gear. Salary within the range £1,375/£1,720 per annum according to qualifications and experience (N.J.B. Schedule B, Grade 5BX). Apply, by letter, within 14 days, stating age, experience, present position and salary, to the Secretary, Midlands Electricity Board, Mucklow Hill, Halesowen, nr. Birmingham.

Birmingham & District Sub-Area

SECOND ASSISTANT DISTRICT ENGINEER
(SOLIHULL)

Extensive experience necessary with underground and overhead High Voltage, Medium Voltage and Protective Systems. Applicants should have technical qualifications commensurate with eligibility for Associate Membership of the I.E.E. Salary: £1,115/£1,245 per annum (N.J.B. Grade G.7).

GENERAL ASSISTANT ENGINEER
(METER AND SPECIAL TESTS SECTION)
(HEADQUARTERS)

The successful applicant should have a good knowledge of meters and metering circuits for both H.V. and M.V. switchgear and the duties will include supervision of the installation of H.V. and M.V. polyphase metering equipment and the investigation of consumers' complaints. Salary within the ranges £765/£870, £825/£940, or £890/£1,015 per annum, according to qualifications and experience (N.J.B. Grades N.18-16). Apply, by letter, within seven days, stating age, experience, present position and salary, to Emil Braathen, Sub-Area Manager, Midlands Electricity Board, 14 Dale End, Birmingham 4.

Shropshire & Herefordshire Sub-Area

THIRD ASSISTANT DISTRICT ENGINEER
(HEREFORD)

Applicants should have had a sound technical training and experience in con-

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struction, operation and maintenance of overhead and underground distribution systems. Technical qualifications desirable. Salary: £890/£1,015 per annum (N.J.B. Grade F.9). Apply, by letter, within 14 days, stating age, experience, present position and salary, to Mr W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gdns, Ditherington, Shrewsbury.

Worcester & District Sub-Area

DEMONSTRATOR (FEMALE)
(EVESHAM)

Applicants must have had a good education and should have a Certificate of a recognised Domestic Training College and/or the E.A.W. Certificate. Some selling experience would be an advantage. Duties include lecture demonstrations in Service Centres and on consumers' premises and advice to consumers on selection and use of electrical apparatus. Applicants must be prepared to take an active part in the sales organisation. Salary: £600/£700 per annum (N.J.C. Grade 1). Apply, by letter, within 14 days, stating age, education, qualifications, training and experience, to District Manager, Midlands Electricity Board, 64 High St, Evesham.

F. W. CATER,
Secretary.
(A 261)

THE SOUTH WALES ELECTRICITY BOARD

DEMONSTRATOR

APPLICATIONS are invited for the position of Demonstrator in the West Mon. District (Ebbw Vale) of the Monmouthshire and Mid-Wales Area.

Salary: N.J.C. Grade 1 (£600/£700 per annum).

Candidates must be competent to give demonstrations and lectures in public halls, consumers' houses or showrooms on cooking, laundering or housecraft subjects. They should also have sales ability for showroom duties and a good knowledge of electrical appliances.

The qualifications required are the Diploma of a recognised Domestic Science College or the Demonstrators' Certificate, and candidate should hold her E.A.W. Certificate.

The person appointed will be required to take part in agreed rotas of Saturday working.

Applications stating age, qualifications, experience and particulars of present duties should be addressed to the undersigned at St. Mellons, Cardiff, to arrive not later than 15 April, 1961.

Envelopes should be endorsed "Demonstrator—36/61."

R. G. WILLIAMS,
Secretary.
(A 262)

THE EAST MIDLANDS ELECTRICITY BOARD

Northamptonshire Sub-Area

Vacancy No. 34/61.
THIRD ASSISTANT DISTRICT ENGINEER
NORTHAMPTON DISTRICT

SALARY: N.J.B. Class G, Grade 9, £965/£1,090 per annum.

The duties of the post will be to assist in the planning, construction, operation and maintenance of underground and overhead systems up to and including 11 kV.

The successful candidate will be required to reside in or near Northampton and to undertake standby duty.

Applications should be forwarded to the Manager, Northamptonshire Sub-Area, 25 Bridge St, Northampton, within 14 days of the date of this advertisement. (A 277)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Chilterns Sub-Area

LUTON DISTRICT

FIRST ASSISTANT DISTRICT COMMERCIAL ENGINEER
60/61.R.

Applicants should have had a good general and technical education and experience in electrical contracting and maintenance work. The successful applicant will be responsible to the District Commercial Engineer for commercial development, supervision of wiring installation work including estimating for all types of industrial, agricultural and domestic installations and such general consumer advisory service as would be anticipated in a District having important industrial, agricultural and housing development. He would also be responsible for operating an efficient maintenance service.

Salary: N.J.B. Class J, Grade 5 (£1,440/£1,610).

Apply by letter to the Manager, Luton District, Eastern Electricity Board, 487 Dunstable Rd, Luton, by 14 April, 1961.

HEMEL HEMPSTEAD DISTRICT

DISTRICT COMMERCIAL ASSISTANT
61/61.R.

Applicants should have a good knowledge of appliances and equipment for use in domestic, small commercial and industrial premises. They should also have had recent experience in modern electrical installation practice and be able to prepare estimates for this work.

Salary: N.J.C. Grade 2 (£700/£775).

Apply by letter to The Manager, Hemel Hempstead District, Eastern Electricity Board, Bridge St, Hemel Hempstead, Herts, by 14 April, 1961. (A 254)

THE SOUTH WALES ELECTRICITY BOARD

ASSISTANT ENGINEER

APPLICATIONS are invited for the position of Assistant Engineer in the Swansea District of the Swansea and West Central Area.

The post will provide a qualified Electrical Engineer with excellent experience of urban and rural development.

Salary: N.J.B. Class G, Grade 11, Scale 5 (£825/£940 per annum). (It is expected that the classification will shortly be raised to "H.")

Applications stating age, present position, present salary, qualifications and experience, should be addressed to G. R. T. Edwards, B.SC., M.I.E.E., M.AM.I.E.E., Manager, Swansea and West Central Area, 29 Ystrad Rd, Swansea Industrial Estate, Swansea, to arrive not later than 15 April, 1961. Please quote reference 35/61/ET, endorsing envelope "Assistant Engineeer."

R. G. WILLIAMS,
Secretary.
(A 234)

COUNTY BOROUGH OF BLACKPOOL

APPLICATIONS invited for appointment of a

SENIOR TECHNICAL ASSISTANT
(APT. 111, £960/£1,140).

Candidates should hold qualifications of Grad.I.E.E. or similar standard, and have experience of specification drafting and contract supervision for lighting and electrical installations, and knowledge of distribution networks.

Application form and conditions from Director of Lighting and Electrical Services, Rigby Rd East, Blackpool, to whom they should be returned by 17 April. (A 236)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

THIRD ASSISTANT ENGINEER
(SITE PROGRESS)

APPLICATIONS are invited for the appointment of Third Assistant Engineer (Site Progress) at Sizewell "A" Nuclear Power Station, Suffolk.

Candidates should preferably possess a Higher National Certificate in either mechanical or electrical engineering and have served a recognised engineering apprenticeship. Experience on the construction of heavy plant as installed in modern power stations either in a manufacturer's works or on site is essential and a knowledge of the civil engineering work involved would be an advantage.

The selected candidate will be required to maintain up-to-date charts on the progress of the works on site in accordance with previously agreed programmes and to assist the Resident Engineer in anticipating any divergence from these programmes.

The salary will be within Grade 7, Scale 13 (£1,285/£1,610 per annum), of the National Joint Board Agreement.

Applications should be made on standard form AE.6, available from the Administrative Officer, Midlands Project Group, P.O. Box 314, Birmingham 30, and should be returned to him not later than 17 April, 1961.

Envelopes should be marked "Confidential—Staff Vacancy No. MPG.19/61." (A 243)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Lanarkshire Area

APPOINTMENT OF THIRD ASSISTANT ENGINEER (TEST)
AREA TRANSFORMER AND PROTECTION TEST DEPARTMENT, MOTHERWELL

APPLICATIONS are invited for the above appointment with the Area Test Department. Candidates should have a sound engineering training, and should preferably be Graduate Members of the Institution of Electrical Engineers or be otherwise suitably qualified. Experience in the repair and testing of power transformers, and in the testing, commissioning, repair and maintenance of modern protective equipment is required. They should also be conversant with voltage drop and short circuit calculations, H.V. fault location and testing techniques. The successful candidate will require to reside within a reasonable distance of the Testing Station, Motherwell.

The conditions of service will be in accordance with the National Joint Board Agreement, the present classification, grading and salary being Scale 10, £1,190/£1,325 per annum.

Application forms which can be obtained from the Manager, Montrose Cres, Hamilton, should be returned duly completed not later than 14 days from the appearance of this advertisement. (A 246)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Project Group

SECOND ASSISTANT ENGINEER
(MECHANICAL)

APPLICATIONS are invited for the appointment of a Second Assistant Engineer (Mechanical) in the Midlands Project Group, based in the first instance at Aberthaw Power Station Site, South Wales.

Applicants should have experience in the manufacture and erection of boilers, turbo-alternators and other mechanical equipment associated with a modern power station.

Applicants should preferably be Associate Members of the Institution of Mechanical Engineers.

The salary will be within Grade 5, Scale 15 (£1,400/£1,830 per annum), Schedule C, of the National Joint Board Agreement.

Applications should be made on standard form AE6, available from the Administrative Officer, Midlands Project Group, P.O. Box No. 314, Bournville, Birmingham 30, and should be returned to him not later than 17 April, 1961.

Envelopes should be marked "Confidential—Staff Vacancy Number MPG.20/61." (A 244)

SOUTHERN ELECTRICITY BOARD

COMMERCIAL ASSISTANT
(TARIFFS AND STATISTICS)

CHIEF Commercial Officer's Department, Head Office, located at Southern Electricity Hse, Littlewick Green, nr. Maidenhead. Salary: N.J.B. Class BX, Grade 5, Scale 14, £1,375/£1,720 per annum. Commencing salary within the range £1,375/£1,570 per annum, according to experience and qualifications. N.J.B. Conditions of Service.

Applicants should have a thorough knowledge of statistical theory and have had experience in the application of modern statistical methods. Experience of consumer surveys and utilisation research investigations is also desirable.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Secretary, at the above address, and returned to him, quoting Z.1331, not later than 14 April, 1961. (A 239)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

FOURTH ASSISTANT ENGINEER
(PROTECTION)

REQUIRED in the Board's No. 2 Sub-Area. Salary within range £965/£1,090 per annum (N.J.B. L/13).

Applicants should have received an engineering training and possess an appropriate technical qualification. Duties will include assistance in testing and commissioning switchgear, transformers and associated equipment up to 33 kV.

The successful applicant will be based at St. Helens initially, but will be required to operate in all Districts of the Sub-Area as necessary.

Appointment subject to medical examination. Pension Scheme.

Application forms obtainable from the Manager, No. 2 Sub-Area, Sandiway Hse, Northwich, Cheshire. Closing date: 13 April, 1961. (A 251)

GAMBIA GOVERNMENT

Electricity Department

ELECTRICAL SUPERINTENDENT

REQUIRED on contract for two tours of 18-24 months. Salary according to age and experience in scale (including Inducement Pay) rising to £1,410 a year. Gratuity 25% of total salary drawn. Outfit allowance £60. Children's allowances. Free passages. Liberal leave on full salary.

Candidates, 32 to 55 years of age, must have had 15 years' practical experience in electrical engineering covering complete knowledge of electrical equipment specification for domestic, business and small industrial installations and should have been trained on the installation section of an Electricity Department.

Apply to CROWN AGENTS, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/51258/EE. (A 233)

SURREY EDUCATION COMMITTEE

GUILDFORD COUNTY TECHNICAL COLLEGE
STOKE PARK, GUILDFORD
DEPARTMENT OF ENGINEERING

APPLICATIONS are invited for the following additional posts commencing 1 Sept., 1961.

TWO GRADE B ASSISTANTS

To teach general engineering subjects, including some mathematics and calculations, in early stages of National Certificate and C. and G. Courses.

Post (a) mainly for Mechanical Engineering and allied subjects.

Post (b) mainly for Electrical Engineering and allied subjects.

Salary in accordance with Burnham Scales for Teachers in Technical Colleges.

Further particulars and application form obtainable on receipt of stamped addressed foolscap envelope from the Principal. (A 242)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division
ASSISTANT MAINTENANCE ENGINEER
(ELECTRICAL)

REQUIRED at Nechells "A" and "B" Power Stations. N.J.B. service conditions, superannuable appointment, salary within Schedule A, Grade K7, £1,350/£1,500 per annum.

A sound technical training and practical experience in electrical maintenance is required, preferably in a modern power station and the possession of an appropriate technical qualification will be an advantage.

Apply, quoting Vacancy No. 85/61MD, on form AE6, available from the Station Superintendent, Nechells "A" and "B" Power Stations, off Aston Church Rd, Nechells, Birmingham, to whom they should be returned to arrive not later than 10 April, 1961. (A 257)

COVENTRY CORPORATION
Require
ELECTRICIANS/CABLE JOINTERS

APPLICANTS must be able to carry out work on all types of installations, together with low tension cable jointing. Pilca cables, insulated armoured cables. Basic rate 5s 8½d per hour, plus incentive bonus. Good conditions of service, including Superannuation Scheme (for men under 38 years of age). Long Service Bonus and Personal Accident Benefit Schemes. Housing accommodation may be available for married men. All employees expected to be trade union members. Application forms from City Engineer, Council Hse, Coventry. Returnable by 10 April, 1961. (A 237)

CENTRAL ELECTRICITY BOARD
OF THE FEDERATION OF MALAYA

APPLICATIONS are invited from suitably qualified FEDERAL CITIZENS OF THE FEDERATION OF MALAYA for the posts of:
ELECTRICAL ENGINEERS (DIVISION I)
Monthly salary scales:
Time scale B: between $740/$950 for a single man; between $870/$1,140 for a married man; between $870/$1,195 for a married man with family.
Time scale A: between $1,000/$1,254 for a single man; between $1,190/$1,430 for a married man; between $1,265/$1,505 for a married man with family.

Candidates, who must be at least 24 and below 40 years of age, must have had a good general education and be Corporate Members or Graduates of the Institution of Electrical Engineers or possess degrees or other educational qualifications carrying exemption from the Institution Graduateship Examinations. They should have had sound training in both Electrical and Mechanical Engineering and experience in the operation of Electricity Supply Undertakings. They should possess a competent knowledge of the erection and maintenance of high and low tension overhead and underground A.C. Distribution Systems and substation plant. Experience in the operation and maintenance of diesel engines an advantage.

Apply to CROWN AGENTS, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/50326/EE. (A 276)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD
APPOINTMENT OF SECRETARY
NO. 3 SUB-AREA

APPLICATIONS are invited for the above appointment at the Headquarters of the Board's No. 3 Sub-Area at Newgate St, Chester.

The duties will include establishments and personnel matters, labour relations, the acquisition of property and wayleaves and general administration, and candidates should have had extensive experience in this field, either in the Electricity Supply Industry or a similar industry. They should preferably possess a recognised secretarial or other suitable qualification. Experience in the administration of superannuation schemes and the handling of common law claims for damages and insurance will be an additional advantage.

The salary will be within the range of £2,170/£2,380 per annum.

Applications should be submitted to the Secretary at Board Headquarters, Love La, Liverpool 3, so as to be received not later than Friday, 14 April, 1961. (A 263)

CORPORATION OF LONDON
ELECTRICAL FOREMAN

TO supervise small staff engaged on maintenance and jobbing repairs. £815/£990 p.a. Contributory Pension Scheme. Medical examination. Apply in writing stating age, experience, etc., and names of three referees, to Superintendent of Works, Corporation of London, 104 Lancaster St, London S.E.1. (A 235)

UNITED KINGDOM
ATOMIC ENERGY AUTHORITY
PHYSICISTS AND CHEMISTS
and
ENGINEERS
required as

Operations Managers at the Dounreay Experimental Reactor Establishment.

Successful applicants will be responsible on shift for the safe and efficient operation of:
1. The high flux materials testing Reactor, its ancillary plant and the experimental test rigs under irradiation in it.
2. The Fast Reactor and its associated steam and electrical generating plant.

Some vacancies also exist for younger men to assist on the Operational side where knowledge and experience will be gained which can lead to the more senior positions in the group.

PHYSICISTS and CHEMISTS—Applicants should hold an Honours Degree or equivalent in Physics or Chemistry with at least three years' relevant experience, or be Associates of the Royal Institute of Chemistry.

ENGINEERS—Applicants must have served a recognised Engineering Apprenticeship and be at least Graduate Members of a recognised senior engineering institution or have an honours degree in Engineering and at least three years' relevant industrial or research experience.

Salaries assessed according to age, qualifications and experience from £1,005/£2,090 per annum.

Rented housing and house purchase assistance available for married officers living beyond daily travelling distance. Hostel accommodation available. Contributory superannuation.

Send postcard for application form to the Personnel Manager, U.K.A.E.A., Dounreay Experimental Reactor Establishment, Thurso, Caithness, Scotland, quoting reference 214/49.

(A 250)

LINDLEY THOMPSON

MIDLANDS SALES REPRESENTATIVE

A Representative is required to promote sales in the Midlands to Area Boards and industrial users. Applicants should preferably have sales experience and some knowledge of power transformers. Applications, which will be treated in strict confidence, stating experience and salary required to:

The Managing Director,
Lindley Thompson Transformer and Service Co. Ltd.,
St. Mary's Rd, Langley, Slough, Bucks. (A 149)

NATIONAL INSTITUTE FOR RESEARCH IN NUCLEAR SCIENCE

Engineer

An engineer is needed to join a section engaged on the operation and maintenance of a 120 MVA power plant comprising a large motor alternator set feeding transformers and an associated converter installation.

The successful candidate will be required to undertake development work of ultrasonic flaw detection equipment of a specialised nature and to be responsible for the satisfactory performance of vibration, eccentricity, torsional twist and temperature measurement equipment. At a later stage other duties concerned with the operation and maintenance of this large power plant may also be required. Applicants should have served a recognised engineering apprenticeship or have had equivalent training. They should be Corporate Members of the Institution of Electrical Engineers or have exempting qualifications. A good knowledge of Industrial Electronics is essential and experience of flaw measurement methods and strain gauging techniques would be an advantage.

Send a POSTCARD for an application form and further details from Personnel Officer, Rutherford High Energy Laboratory, Harwell, Didcot, Berks, quoting reference VN 45/49.

(A 248)

CENTRAL ELECTRICITY GENERATING BOARD
Eastern Division

APPLICATIONS are invited for the following appointments in the Divisional Electrical Department:

FOURTH ASSISTANT ENGINEERS
FINCHLEY (EAST) TECHNICAL SECTION
(S.V. No. 1467)

Salary: N.J.B. Class AX, Grades 11-9, Scales 7-9, £855/£1,245 per annum, plus London Weighting £50 per annum.

The commencing salary will be within the above range according to qualifications and experience.

Previous experience in the commissioning or manufacture of high voltage electrical plant as used in the Board's Generating Stations or Grid Transmission system is desirable.

A knowledge of the design and testing of protective gear would be an advantage.

Applicants should possess a Higher National Certificate in Electrical Engineering or its equivalent.

The applicant appointed will be required to reside in the South East Essex Area.

Applications, quoting Reference S.V. No. 1467, stating age, qualifications, experience and present position, should be sent to the Controller, Central Electricity Generating Board, Eastern Division, West Farm Pl, Chalk La, Cockfosters, Barnet, Herts, to arrive not later than 8 April, 1961. (A 259)

UGANDA ELECTRICITY BOARD

APPLICATIONS are invited for the appointment of

CHARGE ENGINEER

for shift duties at the Owen Falls hydro-electric power station (ultimate capacity 150 MW) on the River Nile at Jinja. Applicants should have had a good education and sound technical training, with subsequent experience in power station operation (not necessarily hydro) and the control of high voltage transmission systems.

Commencing salary depending upon experience within the range £1,872/£2,154 per annum (including 30% gratuity paid monthly).

Uganda has a very pleasant climate and income tax is lower than in the United Kingdom. Passages for employee and family, partly furnished accommodation, medical and dental treatment all free. Five days' overseas leave for every completed month of service in East Africa, plus local leave. Normal tour of duty 24-36 months.

Application forms and further information on Uganda and the Uganda Electricity Board may be obtained from the London Representative, Uganda Electricity Board, Uganda Hse, Trafalgar Sq, London W.C.2, to whom completed forms should be returned not later than 26 April, 1961.

E. H. WILSON,
Secretary.
(A 238)

SCUTH EASTERN ELECTRICITY BOARD
ASSISTANT DISTRICT ENGINEER
KINGSTON DISTRICT

SALARY: £965/£1,090 per annum, under N.J.B. Class G, Grade 9, plus London Weighting. Superannuable. Reclassification is probable from April, 1961. Consideration will be given to a car allowance and assistance with house purchase.

Applicants should be suitably qualified and preferably hold the H.N.C. in Electrical Engineering or equivalent and have had practical experience in general distribution work on systems up to 11 kV.

Applications, quoting ET, on forms from District Manager, Seeboard, 22 Claremont Rd, Surbiton, Surrey, by 12 April, 1961.

GEORGE WRAY,
Secretary.
(A 266)

CENTRAL ELECTRICITY GENERATING BOARD
NORTH EASTERN AND YORKSHIRE REGION
SECOND ASSISTANT STATION CHEMIST
FERRYBRIDGE "A" & "B" POWER STATIONS

APPLICATIONS are invited for the appointment of Second Assistant Station Chemist at Ferrybridge "A" and "B" Power Stations.

Applicants should preferably hold Higher National Certificate in Chemistry and have had previous Power Station experience. A knowledge of the operation of modern water treatment plants would be considered advantageous.

The conditions of service and salary will be in accordance with the National Joint Board Agreement, Grade 11, Class L, Schedule "A" (£1,115/£1,245 per annum).

Forms of application may be obtained from the Assistant Regional Secretary (Personnel), Central Electricity Generating Board, North Eastern and Yorkshire Region, 1 Whitehall Rd, Leeds 1, to whom they should be returned to arrive not later than 17 April, 1961. (A 260)

BACKER ELECTRIC COMPANY LIMITED
require a
DESIGN ENGINEER
DRAUGHTSMAN

Applicants should preferably have experience of electric heating techniques as applied to domestic appliances and/or industrial equipment and be capable of leading and controlling a small drawing office staff engaged on the design and application of tubular sheathed electric heating elements.

Apply stating age, present salary and fullest details of qualifications, education and past experience to the Secretary, Backer Electric Company Limited, Fitzwilliam Road, Rotherham. (A 245)

CENTRAL ELECTRICITY GENERATING BOARD
South Wales Division

APPLICATIONS are invited for the following superannuable N.J.B. Schedule A appointments in the South Wales Division:

PLANT CONTROL ENGINEER
ROGERSTONE POWER STATION
ROGERSTONE, MON
Vacancy No. 59/ET/61.

Salary: Class G, Grade 10, Scale 6, £890/£1,015 per annum, plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualification and have experience of the operation of modern high pressure and temperature unit plant.

ASSISTANT MAINTENANCE ENGINEER (M)
CARDIFF POWER STATION
Vacancy No. 60/ET/61.

Salary: Class F, Grade 8, Scale 7, £965/£1,090 per annum.

Applicants should have experience in the maintenance of heavy plant and possess H.N.C. or equivalent qualifications.

Re-Advertisement
ASSISTANT SHIFT CHARGE ENGINEER
LLYNFI POWER STATION
Nr. BRIDGEND, GLAM
Vacancy No. 61/ET/61.

Salary: Class G, Grade 9, Scale 7, £965/£1,090 per annum, plus 10% shift enhancement.

Applicants should possess H.N.C. or equivalent qualifications and have had operating experience in a modern power station.

Previous applicants need not re-apply.

STATION SHIFT CONTROL ENGINEER
LLANELLY POWER STATION, CARMS
Vacancy No. 62/ET/61.

Salary: Class E, Grade 10, Scale 4, £765/£870 per annum, plus 10% shift enhancement.

Appropriate engineering qualifications and regular apprenticeship desirable, with operating experience in a power station.

THIRD ASSISTANT STATION CHEMIST
CARMARTHEN BAY POWER STATION
BURRY PORT, CARMS
Vacancy No. 63/ET/61.

Salary: Class K, Grade 12, Scale 7, £965/£1,090 per annum.

Applicants should possess H.N.C. (Chemistry) and have experience of testing and analysing coal.

The successful candidate will be responsible to the Station Chemist for a small team of coal samplers and laboratory assistants and to undertake other work leading to a wider experience of modern power station practice.

Special application forms obtainable from Divisional Secretary, Central Electricity Generating Board, South Wales Division, Twyn-y-fedwen Rd, Gabalfa, Cardiff, to be returned by 7 April, 1961. (A 229)

CJB

ELECTRICAL
CONTRACTS ENGINEER

required to act as Assistant to Electrical Contracts Manager.

Candidates should be up to the age of 35 and have served a recognised apprenticeship with a reputable *electrical contractor* followed by at least two years' supervisory duties.

Preference will be given to candidates having a good technical education and experience of industrial and flame-proof installations. Good salary and contributory pension scheme.

Please write, stating age, qualifications, experience and present salary, to:

The Personnel Manager,
CONSTRUCTORS
JOHN BROWN LIMITED,
C.J.B. House, Eastbourne Terrace,
Paddington, London, W.2
quoting Ref. No. K7992.

(A 232)

PIONEER ELECTRIC

CANADA

Senior transformer design engineer wanted. Minimum education H.N.C. in Electrical Engineering. Minimum experience ten years in design of 5 kVA to 50 MVA transformers.

Switchgear design engineer wanted. Minimum education H.N.C. in Electrical Engineering. Minimum experience five years or more in design of metalclad and metal enclosed switchgear up to 15 kV with some knowledge of high voltage circuit-breakers preferred.

Salaries $6,500 to $9,000, depending on qualifications. Full details including photo re education and experience to Pioneer Electric Limited, 1 Rockwood Pl, Winnipeg 19, Manitoba, Canada. (A 162)

THE UNITED SULPHURIC ACID CORPORATION LIMITED

Vacancy for Maintenance Electricians

Preferably with experience of chemical plant and with some knowledge of high tension work. Some technical training is desirable and applicants must be able to use their own initiative.

Basic Pay 5s 2d per hour.
Job Rate 2d per hour.

A Merit Scheme is in operation after one month's service.

Housing may be provided under Local Authority Arrangements.

Applications to:

Labour & Welfare Officer
United Sulphuric Acid Corporation Ltd.,
Green Oaks Works,
Tan House Lane,
Widnes, Lancs (A 241)

TRINIDAD AND TOBAGO ELECTRICITY COMMISSION

VACANCY—ASSISTANT AREA ENGINEER

THE Trinidad and Tobago Electricity Commission has a vacancy for an Assistant Area Engineer.

Candidates must hold a Higher National Certificate in Electrical Engineering or a Degree in Electrical Engineering or be Graduate Members of the Institution of Electrical Engineers and must have had experience in the construction, operation and maintenance of distribution and transmission systems.

The annual salary is £1,310 rising by annual increments to £1,590. A car allowance for necessary mileage is also paid and an interest-free loan is available for the purchase of a car.

A partly furnished house will be provided at a rent of £10 8s 4d per month, plus a small extra charge for heavy furniture.

An outfit allowance is paid of £60 on arrival in Trinidad.

First-class passages to Trinidad will be provided for the successful applicant, his wife and children up to a maximum cost of four adult passages. First-class leave passages to the United Kingdom will be provided every three years.

There is a Superannuation Scheme similar to the C.E.G.B. and Area Board's Scheme.

Information on Trinidad can be obtained from the West India Committee, 40 Norfolk St, London W.C.2.

Applications giving full details of qualifications, age, experience, etc., together with copies of two recent testimonials should be sent by Air Mail to reach the General Manager, Trinidad and Tobago Electricity Commission, P.O. Box 121, Port-of-Spain, Trinidad, West Indies, by 7 May, 1961. (A 280)

SOUTH WESTERN ELECTRICITY BOARD

SECOND ASSISTANT COMMERCIAL ENGINEER (SUPPLY AND TARIFFS)
CORNWALL GROUP—POOL

SALARY within Class J, Grade 6, Salary Scale 12 , £1,350/£1,500 per annum, of the N.J.B. Agreement.

In addition to general assistance to the Group Commercial Officer, duties will include advice to the Districts on the following subjects:

(1) Application of standard tariffs and contract rates, special agreements, street lighting and provision of supplies to new consumers.
(2) Matters relating to Consultative Council.
(3) Industrial and commercial applications of electricity including the design of space heating installations.
(4) Research into questions affecting load and cost of electricity supply and affecting appliances and methods of using electricity.
(5) Installation contracting and consumer service.
(6) Testing and inspection of consumers' installations and the safety of appliances.
(7) Training of staff on technical subjects.

Candidates should possess Corporate membership of the Institution of Electrical Engineers.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POST-CARD ONLY from the Group Administrative Officer, South Western Electricity Board, Pool, Redruth, Cornwall. Closing date for receipt of completed applications is 15 April, 1961.

FOURTH ASSISTANT DISTRICT ENGINEER
TAUNTON—LOCATED AT MINEHEAD

Salary within Class G, Grade 11, Salary Scale 5, £825/£940 per annum, of the N.J.B. Agreement.

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Possession of the Higher National Certificate in Electrical Engineering is desirable

continued in next column

continued from previous column

and the ability to drive a car will be an advantage.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POST-CARD ONLY from the District Manager, South Western Electricity Board, The Parade, Taunton. Closing date for receipt of completed applications is 15 April, 1961.

FOURTH ASSISTANT DISTRICT ENGINEER
(CONSTRUCTION)
WEST CORNWALL

Salary within Class G, Grade 11, Salary Scale 5, £825/£940 per annum of the N.J.B. Agreement.

The person appointed will be responsible to the First Assistant District Engineer (Construction). Duties will include responsibility primarily for supervision of the erection of overhead lines and/or underground cable laying. The successful candidate may be required to undertake standby duties.

Possession of the Higher National Certificate in Electrical Engineering is desirable and the ability to drive a car will be an advantage.

Applications to be made on Standard Form AE6/ACT, OBTAINABLE BY POST-CARD ONLY, from the District Manager, South Western Electricity Board, 13 Basset Rd, Camborne. Closing date for receipt of completed applications is 15 April, 1961. (A 278)

SOUTH OF SCOTLAND ELECTRICITY BOARD

Edinburgh and Borders Area

DISTRICT COMMERCIAL ENGINEER
BORDERS DISTRICT

SALARY: N.J.B. Schedule A, Class F, Grade 2, Salary Scale No. 13, £1,440/£1,610 p.a.

Applications on the standard form obtainable from the undersigned should be submitted not later than 14 April, 1961. Applicants should be corporate members of the Institution of Electrical Engineers or possess qualifications leading to corporate membership. A sound knowledge of a District Commercial Department is necessary, including consumer service, the control and operation of service centres and staff organisation and control of a Contracting Department, tariffs, utilisation and advice to consumers on all matters appertaining to the supply industry. The post is superannuable, subject to satisfactory evidence of health. The successful applicant will require to reside within a reasonable distance of District Headquarters, Galashiels.

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Apply to CROWN AGENTS, 4 Millbank, London S.W.1, for application form and further particulars, stating age, name, brief details of qualifications and experience and quoting reference M2A/51211/EE. (A 255)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

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Midlands Division

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Applicants should have received a sound technical training and should preferably have had experience in the control of a works supply system. Appropriate technical qualifications will be an advantage.

Apply, quoting Vacancy No. 84/61MD on form AE6, available from the Station Superintendent, Walsall Power Station, Reedswood La, Birchills, Walsall, Staffs, to whom they should be returned when completed not later than 12 April, 1961. (A 258)

THE EAST MIDLANDS ELECTRICITY BOARD

Area Board Headquarters

Vacancy No. 37/61.
SECOND ASSISTANT ENGINEER
(CONSTRUCTION)

SALARY: N.J.B. Class BX, Grade 5, £1,375/£1,720 per annum.

The successful applicant should be familiar with the installation of electrical plant, including transformers, switchgear and ancillary equipment up to and including 33 kV. Experience in carrying out underground cable installations and overhead line construction, together with the erection of outdoor substations and liaison work associated with the construction of Grid Supply Points is essential.

Applications should be forwarded to the Chief Engineer, The East Midlands Electricity Board, Mapperley Hall, Lucknow Ave, Nottingham, within 14 days of the date of this advertisement. (A 279)

LONDON ELECTRICITY BOARD

DEMONSTRATOR

APPLICATIONS are invited for the above position in the Board's South Western District. Initially, the successful candidate will be based at 204 Lavender Hill, Battersea, S.W.11, but may be required to work at any Showroom within the District.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate, including Electrical Housecraft, and have experience in conducting demonstrations at Showrooms and general Showroom duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the Showroom and on consumers' premises.

The post is graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 1, i.e., £600/£700 per annum, plus the appropriate London Area Allowance.

Applications stating age, qualifications and experience, should be sent to the Manager at the above address. Please quote ref: PER/W/3220/T. (A 271)

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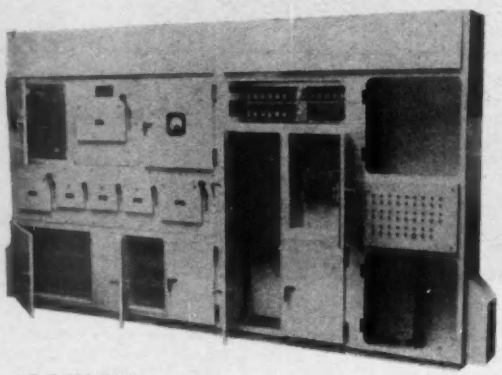

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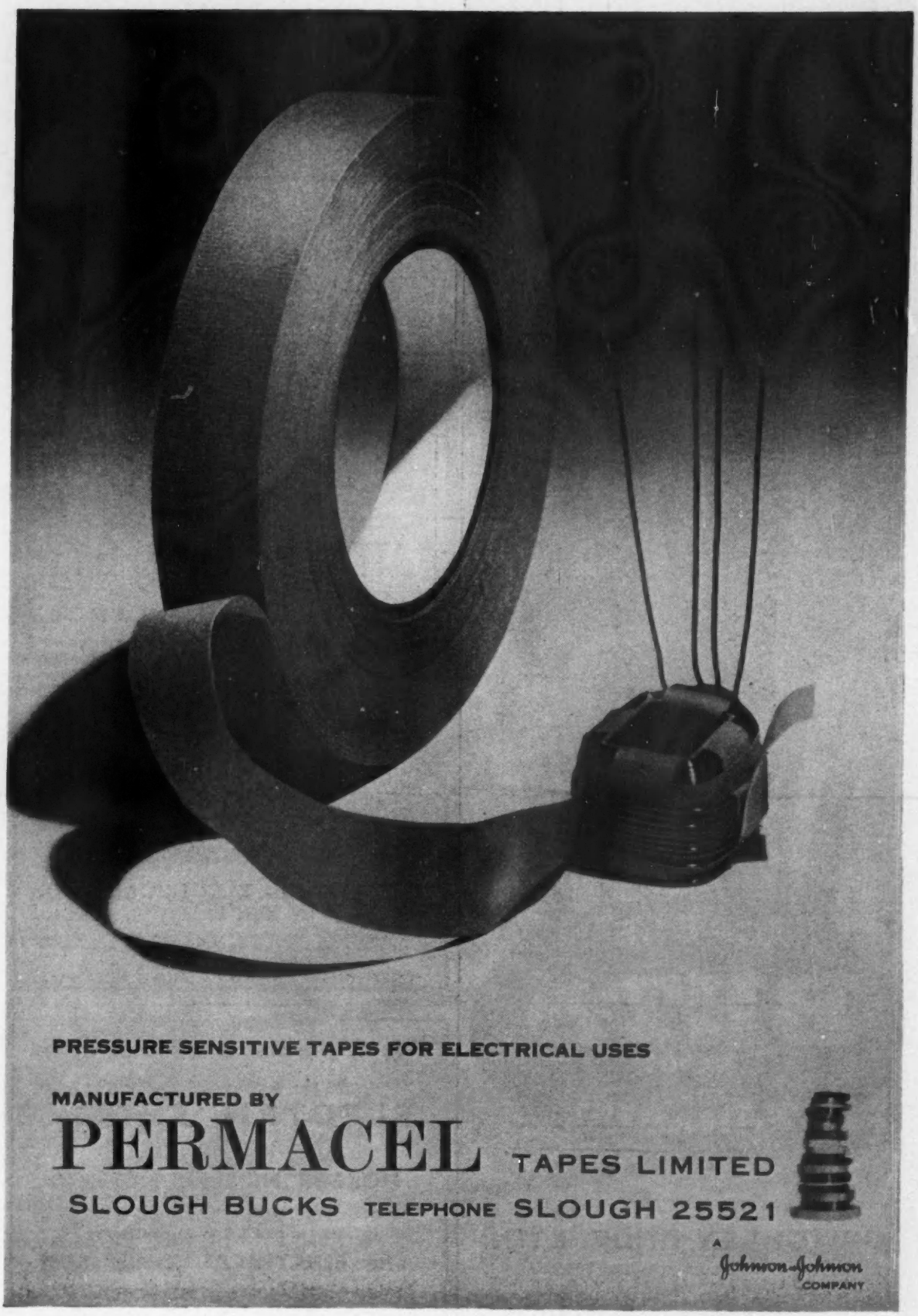
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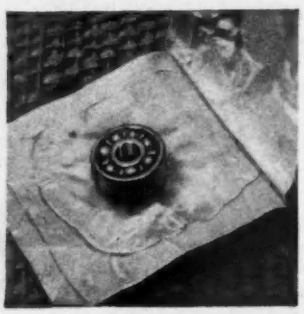

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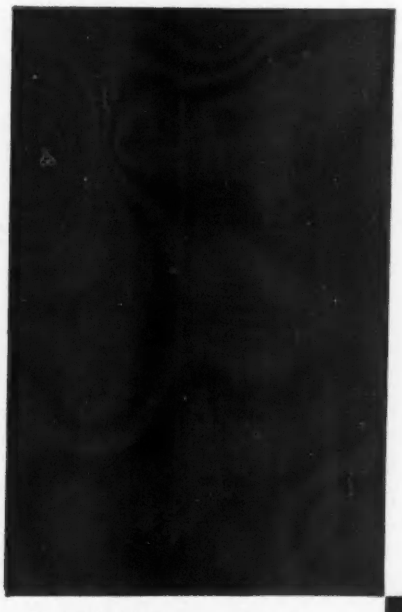

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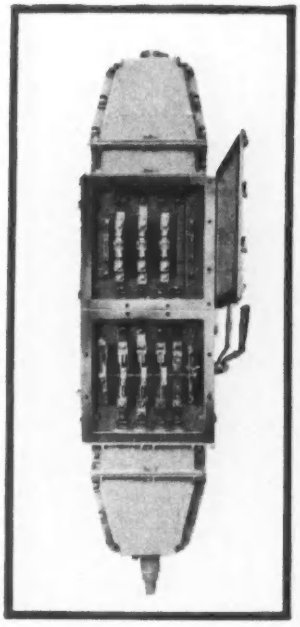

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